ISO-Tek

SPACE PRESSURIZATION MONITOR

SPM-2000, SPM-2100 & SPM-2200 SERIES
INSTALLATION, OPERATION
& MAINTENANCE MANUAL

RELEASE 3.0
MAY 2005
SOFTWARE VERSIONS:
TRANSMITTER E.15
DISPLAY C.5
SETUP TOOL B.11

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ATTENTION - READ THIS PRIOR TO PROCEEDING FURTHER!

1. This manual is designed to provide the user with an in-depth understanding of the ISO-TEK product and its application. However, simplified instructions are also provided for those who want to jump right in and get the product installed and operating.

2. If you are in a hurry, read Chapter 1, Installation and Chapter 2, Quick-Start Setup. If you have some understanding of measurement instrumentation and its application, these instructions should be all that you need to get an ISO-TEK up and running.

3. If you want to get an in-depth understanding of the product and its application before proceeding with the installation, first read Chapter 3, Product Philosophy. Next read Chapter 4, Setup and Adjustment. When you are ready to install the product, go back to Chapter 1. Chapter 2, Quick-Start Setup need not be used, although it will provide a handy reference once you are familiar with the product.

WARRANTY

Tek-Air Systems, Inc. warrants that this product, under normal use and service as described in this Operation and Service manual, is free from defects in workmanship and material for a period of thirty-six months from the date of shipment to the customer. This limited warranty is subject to the following conditions:

- With respect to any repair services rendered, Tek-Air warrants that the parts repaired or replaced will be in good working condition, under normal use, for the period of the original warranty, or for 90 days from date of repair if the original warranty period has expired.

- Unless specifically authorized by Tek-Air in writing, no warranty is made with respect to, and no liability is assumed in connection with, any goods which are incorporated into other products or equipment by the Buyer.

- The foregoing is in lieu of all other warranties and is subject to the conditions and limitations stated herein. No other expressed or implied warranty of fitness for particular purpose or merchantability is made.

The exclusive remedy of the user or purchaser, and the limit of the liability of Tek-Air or any other seller for any and all losses, injuries, or damage resulting from the use of this product shall be the return of the product and the refund of the purchase price or, at the option of Tek-Air or any authorized seller, the repair or replacement of the product. In no event shall Tek-Air or any other seller be liable for any incidental or consequential damages.

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INSTALLATION

Warning: This product contains components that are Electrostatic Discharge Sensitive (ESD). Do not handle or remove the PCB assembly from the enclosure.

A. PREPARATION

The *ISO-TEK* Space Pressurization Monitor that you are about to install will provide accurate, reliable indications of the pressure differences between two separate, enclosed spaces. It is most frequently used in hospital isolation wards, chemical laboratories, critical care and burn units, and other areas where the monitoring of air pressure is vital.

The Space Pressurization Monitor is a critical part of the care and safety of laboratory personnel, hospital patients, health care workers, and others. ***The health of people may depend on the proper installation, setup, and maintenance of this device.***

This manual is designed to make installation of the *ISO-TEK* Space Pressurization Monitor as simple as possible. *Please follow the instructions closely, work carefully and deliberately, and check your work at each stage of completion.* If you run into any difficulties that you cannot resolve on your own, Tek-Air's service department will be happy to help you and can be reached at (203) 791-1400.

Tek-Air is committed to making the task of installing the *ISO-TEK* as simple as possible. We need and appreciate any comments you might have regarding our product or this manual. Please direct these to our Service Department at our office in Danbury, CT.

B. MODEL TYPE

The *ISO-TEK* Space Pressurization Monitor can be ordered in two different arrangements which are determined by the model code. The SPM-2000 does not include the wall mounted display unit. The SPM-2100 & 2200 are complete with the display. Instructions which pertain only to the SPM-2100 & 2200 series will be indicated by a boldface **SPM-2100 & 2200,** in parentheses **(SPM-2100 & 2200 only.**) The exact model type ordered can be determined from the packing list.

C. TOOLS

In addition to standard tools for installing and wiring electrical equipment, you will need a size 00 screwdriver and a 1/16 inch Allen key **(SPM-2100 & 2200 only.**) Depending on your particular installation, tools to cut wallboard or cinder block will also be required. For the setup of alarms, a DC voltmeter will be required.

D. MATERIALS

A 4" x 4" utility box on which the display module **(SPM-2100 & 2200 only)** will mount, is required. Mounting hardware for the utility box is not included.

E. UNPACKING

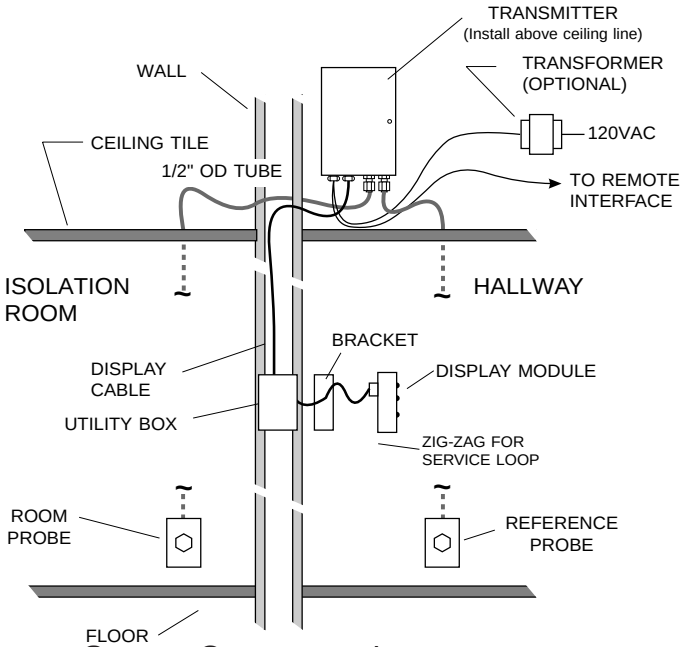
Remove the packing materials from the top of the carton and lay out the *ISO-TEK* Space Pressurization Monitor on a clean work space. The following components should be found in the carton:

- Transmitter Module - one, metallic enclosure containing the main circuit board and pressure sensor, tubing connections, electrical terminations, and data line receptacle.
- Display Module **(SPM-2100 & 2200 only)** - one, metallic enclosure with color-coded display lights and a square, alarm push button on the front. A back bracket and screws should be included with the display.
- Data Cable **(SPM-2100 & 2200 only)** - One, twenty-foot long, data cable with 8-pin, RJ-45, phone-type jacks on both ends.
- Room & Reference Probes - Two (2) nylon bulkhead fittings, each with integral filter and two stainless steel vanity wall plates. (or optional ceiling plates)
- Power Transformer **(Option)** - One, 120 to 24VAC, 40 VA transformer, provided only if specifically ordered. Will power up to four *ISO-TEK*s.
- 1/2" OD Tubing - Two, 15 foot lengths of plenum rated tubing, (one solid black, one striped) provided only if specifically ordered.

If any of the components are determined to be missing, please contact your local representative or Tek-Air's Sales Department immediately, at (203) 791-1400. Please have your order number and our job number available when you call.

F. INSTALLATION STEPS

1. **Locate and Mount the Transmitter -** Determine where the transmitter will be located. It is recommended that the transmitter is installed above the ceiling line on (cinder block or drywall), on the corridor side of the wall separating the room to be monitored from the reference area. The transmitter needs to be accessible for future maintenance. Refer to Figure 1-1.



System Component Layout

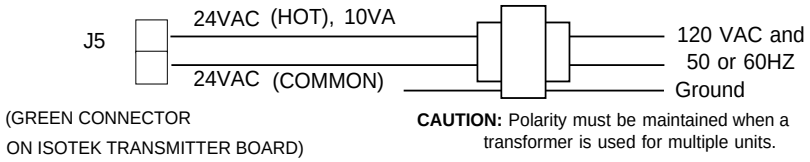
Figure 1-1

Mount the transmitter above the acoustical tile with four (4), #8 dry wall screws, using the four mounting tabs on the side of the enclosure. [**Note for Series SPM-2100 & 2200 only:** When mounting transmitter module, make sure that it is located at an appropriate distance for the length of cable purchased to reach the location of the display module. A 20-foot prefabricated cable with RJ-45 connectors on both ends is supplied for this purpose. Other length cables available on special order.]

2. **Locate and Mount the Power Transformer (Option) -** The transformer supplied with the *ISO-TEK* Space Pressurization Monitor may be located either at the circuit breaker or the transmitter, at the installer's convenience. The case of the transformer must be grounded according to the instructions provided.

3. **Run Power Wiring -** Pull wires for 120 volt service from the circuit breaker to the transformer and splice with the line side black and white wires on the transformer. The transformer case must be grounded. Pull wires capable of handling 24 VAC from the two terminals labeled “load” on the transformer, to the transmitter module. Note that the terminals located on the transmitter board can be removed from the circuit board of the transmitter to make connections easier. Refer to Figure 1-2.

Note: Multiple Transmitters powered by a common power source **need to maintain polarity on J5 connector** for AC power.

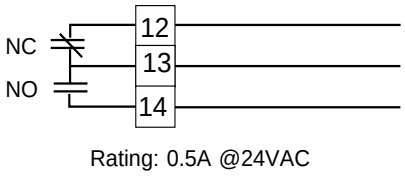


Transmitter Power
Figure 1-2

Connect hot wire on J5 connector, corresponding to "24 VAC+" on the circuit board. The common wire is connected to J5 connector, which is marked "24 VAC-" on the circuit board.

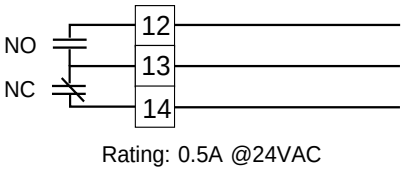
4. **Connections to Remote Interface Devices -** Several remote interface options, which can be used for a variety of applications, are provided. The installer should determine which will be utilized for the application. All wires required for remote interface should be brought in through the two Romex® connectors at the bottom left corner of the transmitter module enclosure.

   Alarm Contact Outputs - Terminals 12, 13, and 14 provide relay contacts that can be connected for remote alarm indication. The contact current is limited to 0.5 amp and only low (less than 30 volts AC or DC) voltage should be used. Wire gauge should not exceed 18 gauge. Contacts in normal (powered-up) state appear as indicated in Figure 1-3. A status change (Alarm Condition) will reverse their condition as in Figure 1-3A.



Rating: 0.5A @24VAC

Figure 1-3

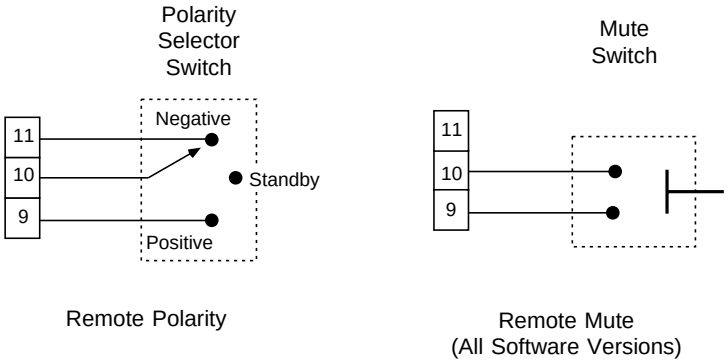


Rating: 0.5A @24VAC

Figure 1-3A

Alarm Contact Connections

Remote Function or Mute Selection - Terminals 9, 10, and 11 allow for the connection of either a remote airflow polarity selector or mute switch. A dry (un-powered) contact must be used for this option. Wire gauge should not exceed 18 gauge. A complete description of how to utilize this feature is contained in Chapter 3. A remote switch is typically connected as shown in Figure 1-4.



Remote Polarity

Remote Mute
(All Software Versions)

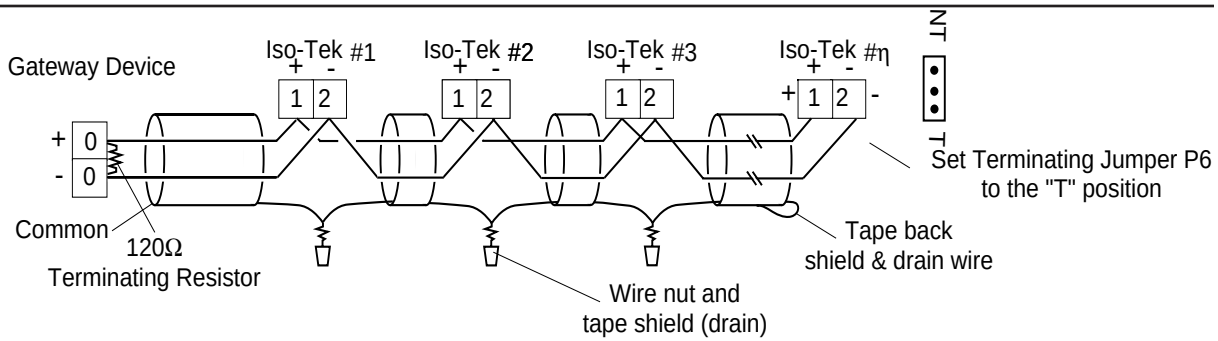
Remote Function Selection

Figure 1-4

Remote Communications Link - Terminals 1 and 2 provide for a direct digital connection to a remote personal computer or building automation system. The SPM Iso-Tek 2000 transmitter is capable of digital communications on an RS 485, two conductor network cable at 9600 baud. Up to 255 units can be addressed on one network. Two communications protocols are available to the user: Tek-Air Open Protocol, and JCI N2 Protocol. In both cases, the SPM-2000 IsoTek can share the network with Tek-Air's FVC-2000plus Fume Hood Controllers. Open Protocol allows the SPM-2000 IsoTek Transmitter to interface the Honeywell Excel system. NOTE: N2 panel Protocol is a direct connection to N2 buss, open protocol requires adapter device.

Tek-Air will make the Open Protocol available to any control system manufacturer. Connections should be made using 24AWG, twisted, shielded cable, as shown in Figure 1-5. Shields should be tied together and only be grounded at one end. The last unit on the communication lone should have the jumper on P6 to the "T" position. All units in the middle of the comminications line should have P6 in the "NT" position. The "end device" should also be terminated (See figure 1-5).

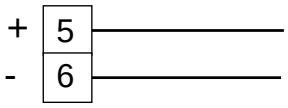
Note: Maintain polarity on all terminal pairs to prevent damage to equipment during power-up.



Communications Connections

Figure 1-5

Analog Output - Terminals 5 and 6 provide the capability of transmitting a 4-20mA, analog current signal which is proportional to either the room transfer velocity or pressure. The scaling range is set either with the DIP switches on the display or with an optional hand-held configuration tool available from Tek-Air. The current signal is a source type (powered) and can be converted to a voltage by using the appropriate resistor (not provided). 22 or 24 gauge shielded wire should be used and the shield should be terminated per BAS requirements. Connections should be as shown in Figure 1-6.



To BAS 4-20mA Output (use resistor(s) for voltage)

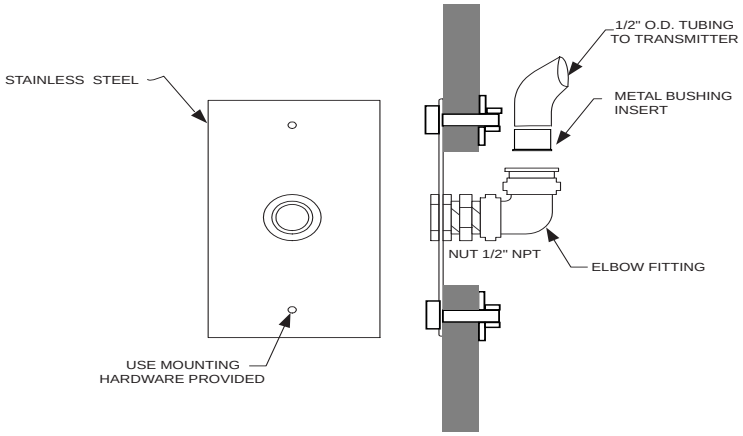
VDC	
1-5	250
2-10	500

Analog Output Connections

Figure 1-6

5. **Locate and Mount Room Wall Probe and Reference Wall Probe -** Each probe consists of a quick-disconnect fitting with a filtered inlet on one end, and one stainless steel plate. Standard 1/2" OD diameter tubing is utilized to connect the probes to the transmitter enclosure and can be purchased from Tek-Air. Refer to Figure 1-7.

   Each probe is normally installed in the wall roughly16" to center above the floor, one in the corridor (reference), and one in the room to be measured. Tek-Air does not normally recommend mounting the reference probe in an anteroom. Refer to Appendix B for technical explanation. Probes must be mounted several feet from any sources of air turbulence such as registers, grilles, or diffusers. The length of tubing used to connect each sensor need not be the same, but the combined length of tubing should not exceed 50 feet. *CAUTION: Reference probes must not be shared between multiple ISO-TEKS.*



Room and Reference Probe Installation

Figure 1-7

6. **Install Sensor Tubing -** Install the 1/2" OD control tubing used to connect the room and reference probes to the transmitter. Make sure that there are no kinks or sharp bends in the tubing. (Tek-Air suggests using tubing in two different colors for ease of installation.) *Insert metal tube inserts into both ends of tubes.*

   Starting at the transmitter fitting marked “REF”, fully insert one end of the sensor tube leading to the probe in the corridor. Connect the sensor end to the corridor sensor in the same manner. Repeat the procedure for both the bulkhead fitting marked "RM" and the room sensor. Assure that tubing fits correctly in fittings and that fittings are tightened.

7. **Install Rough-In Utility Box for the Display (SPM-2100 & 2200 only) -** If the display module is to be incorporated into your system, determine its location. The display is normally mounted just above eye level (about five feet), on the wall outside of the door leading into the room to be monitored. This location makes it easy to check the display status as one enters the room, while keeping the display unobtrusive.
   Rough-in a 4"x4" double gang box at the location selected. Before installing the box, make sure that the *ISO-TEK* mounting bracket provided fits. Remember that the display cable provided is 20 feet long and so the display must be within a 20 foot cable run of the transmitter. Cables up to 100 feet are available as an option.

8. **Pull and Connect The Display Cable (SPM-2100 & 2200 only) -** Carefully pull the display cable between the utility box and the transmitter. Leave a six inch service loop at the display end of the cable to allow for sufficient space to work on the display with the cable plugged in. Pull the cable into the transmitter through the right knockout at the bottom of the enclosure. If conduit is not used, use a romex type squeeze connector to provide strain relief. Plug the cable into the female receptacle provided inside the transmitter.

9. **Mount the Display Bracket (SPM-2100 & 2200 only) -** Mount the bracket for the display module on the utility box installed in step 7. Use either two or four screws (provided) and the appropriate mounting holes on the back of the bracket to secure it onto the 4" square utility box you installed in Step #1. The U-shaped sides of the bracket should be facing toward you and the large square hole in the bracket should be facing toward the top.

10. **Set the Display Module Configuration Switches (SPM-2100 &2200 only) -** Review the settings of the configuration switches on the rear of the display module. The unit will operate with factory settings, but you may wish to change these.

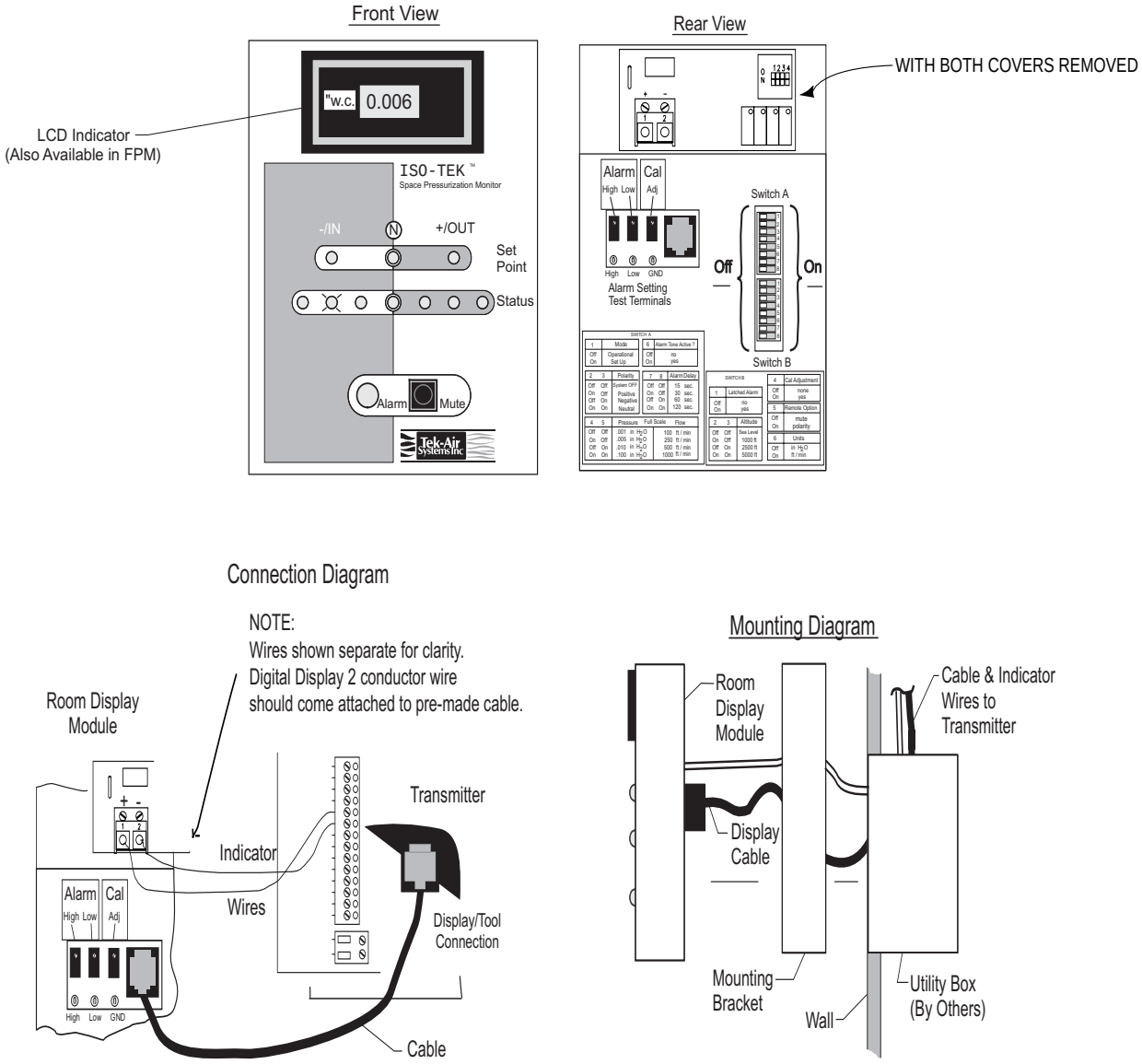
    NOTE: The configuration of the ISO-TEK unit determines how it functions and which features will be activated. Configuration settings are usually established by the operating staff. Refer to Chapters 2,3 & 4 in this manual for details on configuring the unit.

11. **Mount the Display Module (SPM-2100 &2200 only) -** Fold the display cable in a zigzag manner to allow it to push back into the utility box. Plug the male connector on the end of the display cable into the female connector on the display module. Carefully mount the display on the bracket and secure with the two 1/16" hex head screws provided. These may be temporarily left loose, until the alarm point settings are made. See note #14 below if your unit is an SPM-2200 and includes an LCD on the display module.

12. **Double Check All Connections -** Review connections to power, remote interface devices, and display **(SPM-2100 only)** to be sure that they are correct before applying power to the unit. *Improperly connected wires will damage the unit when powered up.*

13. **Power Up Unit -** Activate the circuit breaker that feeds the power transformer. The unit should begin to function. Proper functioning can be verified by observing the status indicator LED inside the transmitter, next to the multi-position switch; this should be flashing. In addition, one of the set point indicators on the display module should be lit, and should flash off and on every few seconds.

14. **Note:** On Model SPM-2200, the display module has an additional LCD display which needs to be connected electrically. There are two conductors on each end of the plug-in cable which are separate from the plugs. These two conductors connect to the LCD. + & - terminals on the back of the display, and to terminals 5 & 6 of the transmitter board. See figure 1-8 for SPM-2200 wiring and set-up.



NOTE: LCD CONNECTION NOT PROVIDED ON 2100

wiring for SPM-2100 & 2200

fig 1-8

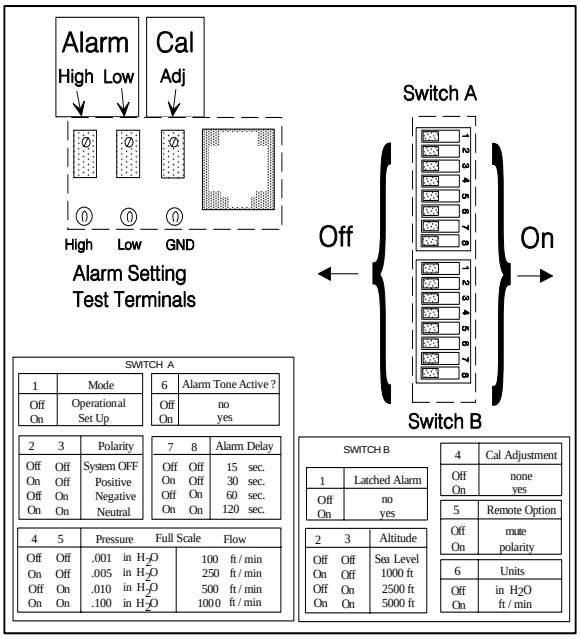
Unit can be respanned using potentiometers on back of unit if the range of the SPM transmitter is to be changed in the field AFTER shipment from the factory. Otherwise, the LCD is factory matched to the factory settings of the SPM transmitter and need not be adjusted.

QUICK-START SETUP

Warning: This product contains components that are Electrostatic Discharge Sensitive (ESD). Do not handle or remove the PCB assembly from the enclosure.

CHAPTER GOALS

The following instructions are designed only to provide an overview of the device for room pressure monitoring. For complete and detailed instructions, refer to Chapters 3 and 4. Setup of this device is extremely simple, performed through configuration switches and adjustments on the rear of the display module. Refer to Figure 2-1.


Alarm
High Low
Cal
Adj
High Low GND
Alarm Setting
Test Terminals
Switch A
Off
On
Switch B
SWITCH A
1 Mode: Off Operational, On Set Up
6 Alarm Tone Active ?: Off no, On yes
2 3 Polarity: Off Off System OFF; On Off Positive; Off On Negative; On On Neutral
7 8 Alarm Delay: Off Off 15 sec.; On Off 30 sec.; Off On 60 sec.; On On 120 sec.
4 5 Pressure Full Scale Flow: Off Off .001 in H2O 100 ft/min; On Off .005 in H2O 250 ft/min; Off On .010 in H2O 500 ft/min; On On .100 in H2O 1000 ft/min
SWITCH B
1 Latched Alarm: Off no, On yes
2 3 Altitude: Off Off Sea Level 1000 ft; On Off 2500 ft; Off On 5000 ft; On On 5000 ft
4 Cal Adjustment: Off none, On yes
5 Remote Option: Off mute, On polarity
6 Units: Off in H2O, On ft/min

For SPM 2100, and 2200 models only: units are normally configured in the field. Tek-Air will configure them at the factory to users requirements if the desired settings are specified. Otherwise, the following default settings are used:

Mode:	Operational
Alarm Tone:	Yes
Polarity:	Negative
Alarm Delay:	30 sec.
Pressure:	.010 in H_2O
Flow:	500 ft./min.
Latched Alarm:	No
Altitude:	Sea Level
Cal. Adjust.:	None
Remote Option:	Mute
Units:	In H_2O

Rear of Display Module
Figure 2-1

A. CONFIGURATION

The personality of the unit is established through the setting of "DIP" (dual, in-line package) switches. These switches can be set to either the "ON" or "OFF" position with a pen or paper clip. They are as follows:

Switch A-1; Mode Selection- "OFF" is the normal mode for operation. All delays will be in effect when set to "OFF". "ON" is used in setup to deactivate the delay period. This is especially helpful when setting alarm limits because the user can observe the alarms take effect immediately, rather than having to wait for the delay period to time out.

Switches A-2 and 3; Polarity- These settings establish the airflow polarity of the alarm action. The "System OFF" setting puts the unit in the standby mode. It operates, but does not send out alarm signals. "Positive" establishes the normal room condition as having the room pressure greater than corridor pressure, and so air flows out of the room into the corridor. Positive might be used for HIV patients. "Negative" establishes the normal room condition as having the room pressure less than the corridor, and so air flows into the room from the corridor. Negative might be used for TB patients. "Neutral"

establishes the normal condition as having the room and corridors at the same pressure, and so air does not flow between them.

Switches A-4 and 5; Full Scale Range - These establish the range of operation of the display LEDs (light emitting diodes) and the 4-20mA analog output. They should be selected to maximize the sensitivity of the unit. The range selected is in either feet per minute (FPM) or inches water column ("wc), depending on the setting of switch B-6. The ranges shown are bi-directional, meaning they are plus and minus (e.g. 250 FPM is -250 to +250 FPM.) Typically, for hospital isolation rooms either the .005/250 or .010/500 setting is appropriate. NOTE: On Model 2200, the LCD indicator range must match this range. If not, the zero and span pots on the LCD can be used to match the display to the selected transmitter range. A 4-20 mA generator can be used to drive the LCD by disconnecting the LCD + and - wires from the transmitter and connecting the generator in its place. At 4 mA, the display must read the appropriate minimum value. If not, adjust the Zero "course" and "fine" pots. At 20 mA, the display must read the appropriate Maximum value. If not, adjust the Span "course" and "fine" pots Then re-connect the transmitter to the LCD when finished.

Switch A-6; Alarm Tone Active? - This switch allows the user to turn off (deactivate) the alarm horn when it is desirable. When set to "NO", all alarm functions operate, except the horn.

Switches A-7 and 8; Alarm Delay - These establish the delay period for the activation of the alarm horn, light, and relay associated with the unit. Generally, 15 seconds is appropriate.

Switch B-1; Latched Alarm - This switch determines if the alarm indications (horn, lights, relay) are cleared automatically when the alarm condition clears, or if the alarm will be latched (held) until the alarm MUTE button is pushed. Normally this is set to "NO" for not latched.

Switches B-2 and 3; Altitude - Altitude affects the output of the sensor in the *ISO-TEK* unit. Set this switch for the altitude which is closest to the altitude at your location.

Switch B-4; Cal Adjustment - The feet per minute of flow between two rooms is a function of the differential pressure between them and the area of crack space through which the air flows. As the ratio of room space to crack space differs from room to room, the "flow coefficient" may differ also. In most cases, because the crack area is so small compared to the room area, the coefficient is very predictable and this is what the factory setting is based on. In some cases, you may find differences between what the unit reads and what a thermal anemometer placed under the door reads. Setting this switch to "ON" activates the calibration adjustment, which can then be turned until the output of the unit agrees with the thermal anemometer.

In these cases, this switch may be set to "YES" to activate the calibration adjustment marked "Cal Adj." This multi-turn potentiometer can be rotated in either direction until the output of the *ISO-TEK* agrees with the thermal anemometer. *CAUTION: Using thermal anemometers correctly requires care, skill, and the proper technique. At low*

flows these instruments are typically no better than ±10% of reading. Therefore, this adjustment should not be made to trim slight variations (within ±10%) between devices.

Switch B-5; Remote Option - In many instances it is desirable to interface the *ISO-TEK* to either a remote mute or polarity indexing switch. A remote mute switch allows the use of an external contact closure to silence the audible alarm horn. The polarity switch indexes the airflow controls in the supply and exhaust serving the room, providing either positive, negative, or neutral pressurization.

For units with Rev. D.00 (or later) transmitter software, with switch B-5 set to “Mute”, shorting terminals 10 and 11 momentarily will cause an activated alarm horn to silence. With switch B-5 to “Polarity”, *ISO-TEK* can be indexed via a remote switch, to either the negative, neutral, or positive mode of operation to match the needs of the room. The unit can also be placed on standby. For details, refer to the wiring diagram in Figure 1-4 in Chapter 1, Installation.

Switch B-6; Units- This switch allows the user to set the output of the *ISO-TEK* for either inches of water column or feet per minute. Both are acceptable for the proposed Federal Guidelines. Pressures should be equal to or greater than 0.001 inch and flow velocities should be greater than 100 FPM.

B. CALIBRATION

Alarms are calibrated in the following manner, using a voltmeter. Having set each of the DIP switches listed above, note the settings for "Full Scale" range and "Units". Determine the high and low alarm settings to be used in the appropriate units. For positive and negative rooms using flow, 100 FPM is a typical low alarm point, and 250 a typical high point (unless the room is very airtight.) A typical low setting using pressure is 0.001", and .0038" a typical high setting.

Determine the setup alarm voltage from the Table 2-1. As an example, find the voltage for 100 FPM with a full scale range of 500 FPM. From the table, find the 500 column in the "Feet per Minute Scales." Move down to find the low value of 100 FPM and note that 1.0 volt is shown in the "Alarm Voltage" column.

Determining the appropriate alarm voltage for neutral rooms differs from the negative and positive rooms only in that the low alarm setting is used. The low alarm setting then triggers an alarm on either side of the neutral point so, if the unit were calibrated for a low alarm of 150 FPM, any time the flow exceeded 150 FPM in either direction, the low alarm would trigger.

Connect the common lead of the voltmeter to the GND test point under the adjustment marked "Cal Adj" on the back of the display module. Connect the plus lead of the voltmeter to the test point marked "Low." Set the voltmeter for DC Volts and read the voltage. Adjust the potentiometer marked "Alarm Low", until the voltmeter reads the voltage indicated on the chart given the selected units and full scale.

To adjust the high alarm setting, move the positive lead of the voltmeter to the test point marked "High." Set the voltmeter for DC Volts and read the voltage. Adjust the potentiometer marked "Alarm High", until the voltmeter reads the voltage indicated on the chart

according to selected units and full scale.

To determine the actual room pressure, one of two methods may be used. The first method utilizes the milliamp (mA) output of the transmitter. Again, note the "Units" and "Full Scale" configurations selected previously. Place the positive lead from a digital voltmeter indexed to the current mode, across terminal 5 and the negative on 6, in the transmitter module. Read the mA indicated by the voltmeter and, using Table 2-1, determine either the feet per minute or the pressure.

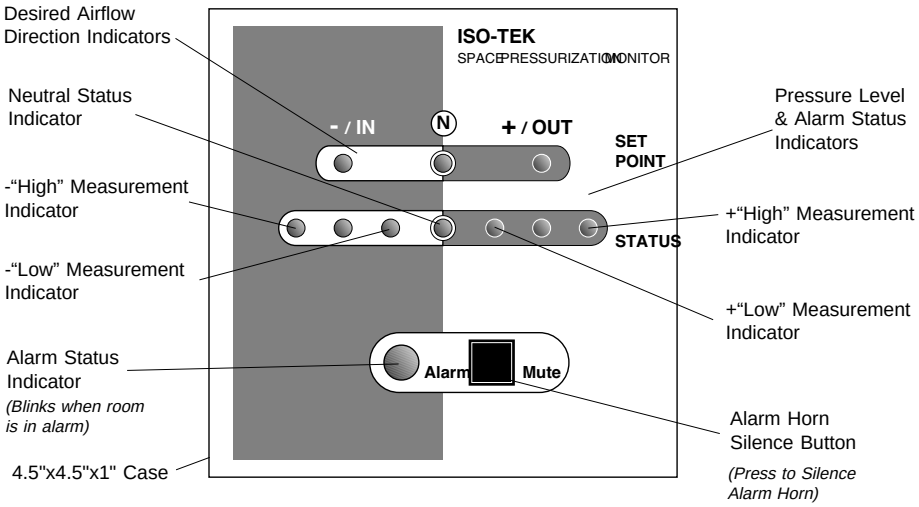
The second method uses the alarm adjustment. Set the "Mode" switch to "ON" to place the unit in the setup mode. If the alarm is active, turn the Low alarm adjustment counter-clockwise to lower the setpoint until the alarm clears. If the alarm is not active, turn the low alarm adjustment clockwise, until the alarm horn activates. With a voltmeter, measure the voltage between the GND and Low test points. Using the appropriate Units and Full Scale configurations, compare this voltage to Table 2-1 (below) to determine either the FPM or inches water to which the room is pressurized. Remember to set the Low alarm adjustment back to the desired voltage when done, and return the "Mode" switch to "Operational."

DVM Readings			Feet per Minute Scales				Inches Water Scales			
Alarm Voltage	Current; Negative	Current; Positive	100	250	500	1000	0.001	0.005	0.01	0.1
0.00	12.00	12.00	0	0	0	0	0.00000	0.00000	0.0000	0.0000
0.25	11.60	12.40	5	13	25	50	N/A	0.00025	0.0005	0.0050
0.50	11.20	12.80	10	25	50	100	0.00010	0.00050	0.0010	0.0100
0.75	10.80	13.20	15	38	75	150	0.00015	0.00075	0.0015	0.0150
1.00	10.40	13.60	20	50	100	200	0.00020	0.00100	0.0020	0.0200
1.25	10.00	14.00	25	63	125	250	0.00025	0.00125	0.0025	0.0250
1.50	9.60	14.40	30	75	150	300	0.00030	0.00150	0.0030	0.0300
1.75	9.20	14.80	35	88	175	350	0.00035	0.00175	0.0035	0.0350
2.00	8.80	15.20	40	100	200	400	0.00040	0.00200	0.0040	0.0400
2.25	8.40	15.60	45	113	225	450	0.00045	0.00225	0.0045	0.0450
2.50	8.00	16.00	50	125	250	500	0.00050	0.00250	0.0050	0.0500
2.75	7.60	16.40	55	138	275	550	0.00055	0.00275	0.0055	0.0550
3.00	7.20	16.80	60	150	300	600	0.00060	0.00300	0.0060	0.0600
3.25	6.80	17.20	65	163	325	650	0.00065	0.00325	0.0065	0.0650
3.50	6.40	17.60	70	175	350	700	0.00070	0.00350	0.0070	0.0700
3.75	6.00	18.00	75	188	375	750	0.00075	0.00375	0.0075	0.0750
4.00	5.60	18.40	80	200	400	800	0.00080	0.00400	0.0080	0.0800
4.25	5.20	18.80	85	213	425	850	0.00085	0.00425	0.0085	0.0850
4.50	4.80	19.20	90	225	450	900	0.00090	0.00450	0.0090	0.0900
4.75	4.40	19.60	95	238	475	950	0.00095	0.00475	0.0095	0.0950
5.00	4.00	20.00	100	250	500	1000	0.00100	0.00500	0.0100	0.1000

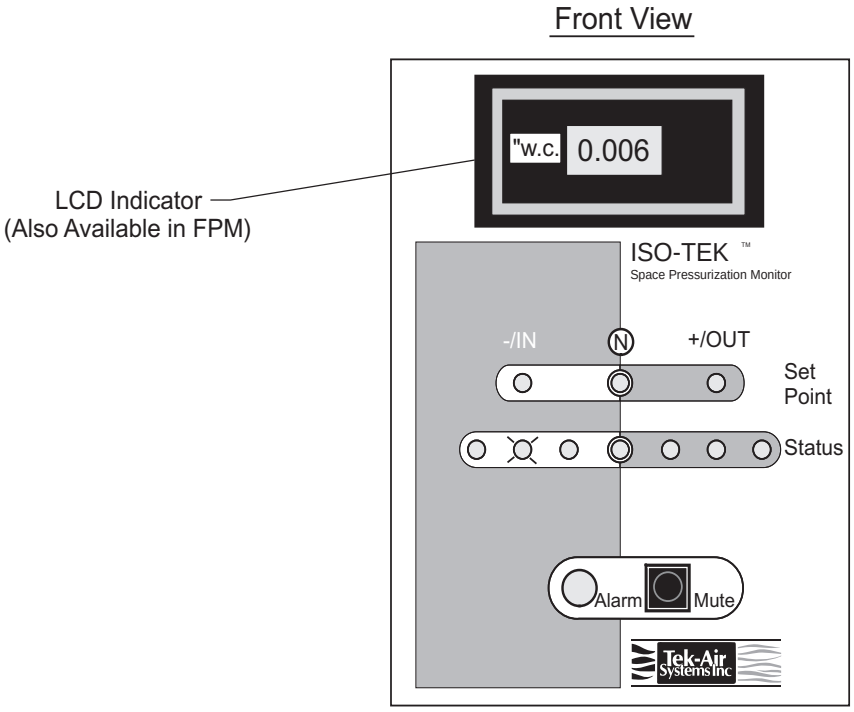
Alarm Setup Voltages
Table 2-1

C. DISPLAY FUNCTIONS

Figure 2-2 (below) indicates how to interpret the display indicators.



SPM-2100 ISO-TEK Display
Figure 2-2



SPM-2200 ISO-TEK Display

Warning: This product contains components that are Electrostatic Discharge Sensitive (ESD). Do not handle or remove the PCB assembly from the enclosure.

CHAPTER GOALS

This chapter is intended to familiarize the user with the capabilities and theory of operation of the *ISO-TEK*™ SPM-2000/2100/2200. This chapter should be read prior to commissioning the unit.

A. PRODUCT GOALS AND EXPECTATIONS

The *ISO-TEK* has been designed to continuously monitor the extremely small air pressure differences between two spaces. The unit will provide reliable monitoring and alarming when installed and commissioned properly. Principal reasons for using the product include:

- To continuously monitor the direction and rate of the transfer of air between two spaces, typically a room and its adjacent hallway, in either Feet Per Minute (FPM) or in inches of water column ("wc.)
- To alert employees and staff to changes in the status of airflow between the two spaces which may have an impact on their safety and health.

However, the *ISO-TEK* provides many more features which benefit the user. Among these are:

- Extremely sensitive measurement capabilities; velocities as low as 20 FPM and pressures as low as 0.0001"wc.
- Visual assurance of safety to workers via a simple, intuitive display. The simplicity of the display insures that the time required to train staff is minimized.
- A wide range of configurable features providing the user with the freedom to configure the operation of the monitor to match special application requirements.
- Usable with or without local display module.
- Simple installation and setup. No large penetrations between spaces are required.
- Multiple interface paths to other building systems, such as building automation, data acquisition, and nurse call systems. Interface can be accomplished through analog signals, contact closures, and digital communications.
- High reliability through the use of state of the art sensing and circuitry.
- Low maintenance due to inherent simplicity.

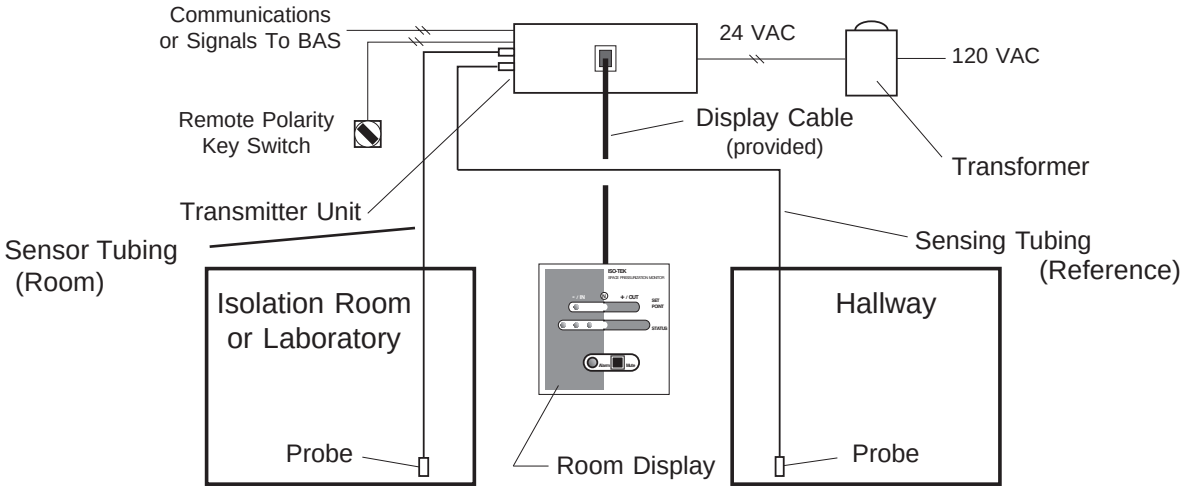
ISO-TEK is designed to be used in a wide variety of applications, from hospital isolation rooms to chemical laboratories. The sensing system is specifically designed for rooms where pressure levels are so low that they can't be reliably measured by conventional diaphragm sensors.

ISO-TEK can be provided in two configurations to meet the user's specific needs. The SPM-2100 is a complete system, consisting of a transmitter and local display. The SPM-2000 system consists of only the transmitter and is designed to be used where a local display is not required.

When the SPM-2000 is purchased, the user can choose from three methods to configure the transmitter for an application; factory configuration, configuration by digital communications, or configuration through Tek-Air's SPM-7000 configuration tool.

B. OVERALL OPERATION AND THEORY

The *ISO-TEK* SPM-2100 system consists of four major components; the transmitter module, the display module, the room sensing probe, and the hallway (reference) probe. Refer to Figure 3-1. The transmitter is the heart of the unit, consisting of the airflow sensor and microprocessor-based electronics. While the transmitter is normally provided with a room display module, when purchased alone as a SPM-2000, it is fully capable of functioning as a stand-alone unit. A display module can be added to the SPM-2000, provided the customer has a hand-held calibration tool (Tek-Air Option), or sends the unit back for re-configuration.



Monitor System Components
Figure 3-1

The transmitter is typically mounted above the hung ceiling of the hallway. The transmitter provides several types of logic and signal interfaces to meet the requirements of a wide variety of applications. Simple interface to building management systems includes contact closures for alarms and a 4-20mA analog output signal for transmitting measurement values. The transmitter can be interfaced to contact inputs for remote indexing of airflow polarity, or to remotely mute the alarm horn. Full, seamless integration with many building automation systems can be achieved with *ISO-TEK'*s direct digital RS-485 communications.

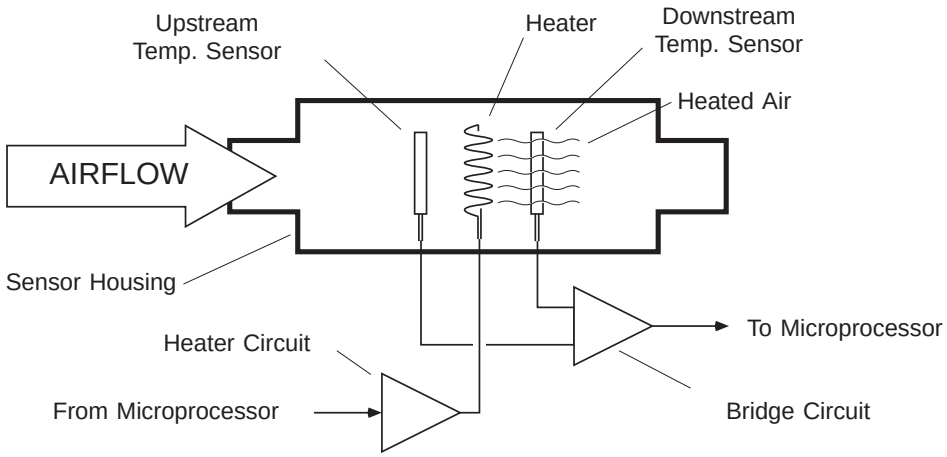
Two space pressure probes are provided with each pressure monitoring system. One is mounted in the room to be monitored and the second is in the reference space, typically a hallway. These probes are designed to minimize the effect of air turbulence on the measurement pickup points. The probes connect to the transmitter by means of standard, 1/2" OD control tubing, which may equal up to fifty feet in combined length. The small size of the tubing eliminates the need for large penetrations normally associated with "through the wall" type thermal anemometers.

The room display module is provided with the SPM-2100 & SPM-2200, and it is designed to be used where the continuous visual monitoring of the space pressurization status is required. The display includes set point and status lights, an alarm horn, and an acknowledge button. The room display module can be mounted in the lab, patient room, anteroom, or in the hallway, on a standard, 4"x4", electrical utility box.

C. SENSOR PRINCIPLE OF OPERATION

The *ISO-TEK* utilizes thermal mass flow sensing to determine the velocity of the air moving between rooms. Refer to Figure 3-2. The sensor assembly is housed in the transmitter electronics enclosure and connects with the room sensing probes by standard control tubing. An extremely small volume of air moves from the higher pressure space to the lower pressure space by passing through the tubing and the sensor. The velocity of flow is based on the difference in pressure between the two rooms.

The sensor assembly is a housing which encloses two, resistance type, temperature sensors, with a resistance heater between them. The two sensors and the heater are each "micro-machined" from silicon, and are extremely low in mass. The low mass decreases the response time of the sensor to a few milliseconds, much faster than conventional warm-wire sensors.



Thermal Mass Flow Sensor
Figure 3-2

Air can move through the sensor in either direction, depending on which room is lower in pressure. The power to the heater is controlled so that the surface temperature of the heater remains at a constant differential, above ambient. The upstream sensor first measures the temperature of the air prior to being heated. The downstream temperature sensor senses the increase in the temperature of the air as it exits. The greater the velocity (volume) of the air passing across the heater, the greater the difference in temperature between sensors. If the airflow direction changes, the reverse occurs.

The electrical signals generated by the up and downstream temperature sensors are sent to the microprocessor, where they are converted to the airflow direction, differential pressure, and velocity.

D. TRANSMITTER FUNCTIONS

One of the main benefits of the *ISO-TEK* transmitter is that it can be configured to meet the requirements of a user's specific application. Should those requirements change over time, the unit may be re-configured as required. Configuration is possible because the transmitter is microprocessor based. The features which can be configured are as follows:

- Pressurization polarity: negative, neutral, positive, or standby
- Measurement in FPM or inches H_2O
- Range of operation (4)
- Alarm limit adjustment
- Period of time delay before alarm occurs
- Latching or non-latching alarm selection
- Deactivate/activate audible alarm
- Remote polarity adjustment or muting
- Altitude of the transmitter

With the SPM-2100 & 2200, configuration can be accomplished in several ways, the most common being through the setup switches on the rear of the display module. When the unit is active, these switches are read continually by the transmitter and used as the basis of operation.

The transmitter is factory calibrated by comparing the measured electrical signals from the sensor to known values of velocity and pressure from Tek-Air's wind tunnel. These values are stored in the permanent memory of the microprocessor as a multi-point calibration curve, providing high accuracy over a wide range of operation.

In the case of the SPM-2000, the transmitter can be factory configured for a specific installation. An alternate method involves using the SPM-7000 configuration tool to store the configuration parameters and download them to the transmitter. When the tool is removed, the transmitter then operates with the settings memorized from the tool. The tool can be reconnected at any time, to change the desired configuration.

One additional means of configuring either the SPM-2100 or the SPM-2000 transmitter involves downloading parameters through the built-in, digital communications link. This method is covered in a supplemental manual, provided on request.

Desired Airflow Polarity - In most applications, it is desirable to have air flow in one direction only. Should the air flow in a different direction, an alarm should occur. TB isolation rooms and chemical laboratories usually require negative isolation to insure that air from adjacent spaces flows into the room being monitored. Other applications require positive pressurization.

ISO-TEK can be set up to monitor either negative, positive, or neutral airflow polarity. In addition, the polarity can be deactivated so that the unit is placed in the standby mode. This is useful when a room is not being used or when the polarity of the airflow is not critical. All transmitter functions continue to occur when in the standby mode, with the exception of alarm functions. The set point and status lights are not active.

Desired Measurement Units - The two most commonly used units for expressing the magnitude of the space pressurization are; inches of water column("wc) and feet per minute (FPM). "wc are units of pressure measurement and define the difference in pressure between two spaces. FPM are units of velocity measurement and define the velocity of the air moving through crack spaces (generally around doorways) between the two spaces.

The velocity of the air flowing between spaces correlates to the pressure by the formula below, where the constant K is a number relating to the orifice coefficient of the crack space, compared to the area of the room.

ISO-TEK measures in "wc, but can convert this measurement to FPM, as required by the customer's application.

$$FPM = K \times \sqrt{(\text{inches water})}$$

Desired Range of Operation - Depending on the application, the magnitude of the pressures or velocities being measured may differ greatly. Typically, laboratories and patient rooms not specifically built to provide a high degree of pressurization, operate with very small pressure differences, typically .0025"wc or less. On the other hand, clean rooms and high containment labs have extremely "tight" construction and can be pressurized to levels fifty to one hundred times higher.

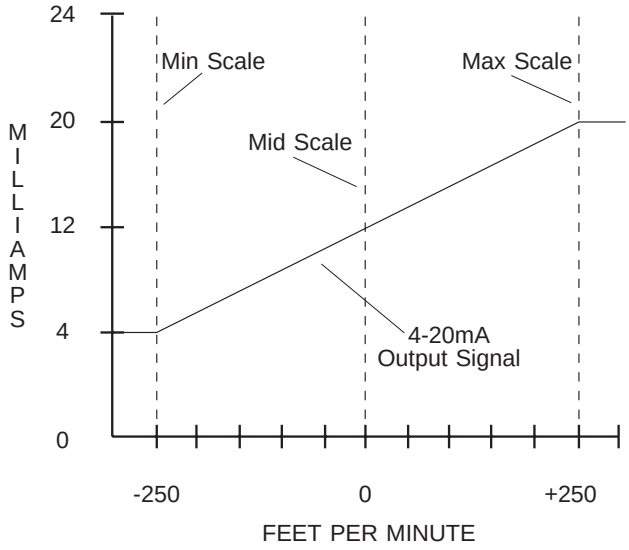
FPM	"wc
±100	±0.001
±250	±0.005
±500	±0.01
±1000	±0.1

Table 3-1

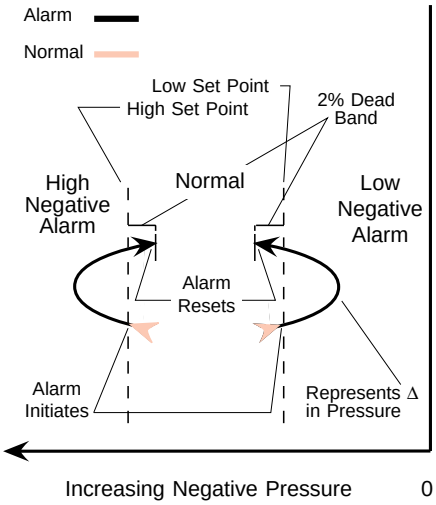
The range of operation of the *ISO-TEK* can be set for any of the following selections shown in Table 3-1. Refer to Chapter 4 for instructions on how to set this parameter.

To operate properly in each of these situations, the range of operation must be selected so as to maximize the resolution of the measurement. Just as an automobile speedometer with a maximum speed of 1000 mph would be useless in a car (because such a small portion of the display range would be used in normal driving,) the measurement range must be matched to the application.

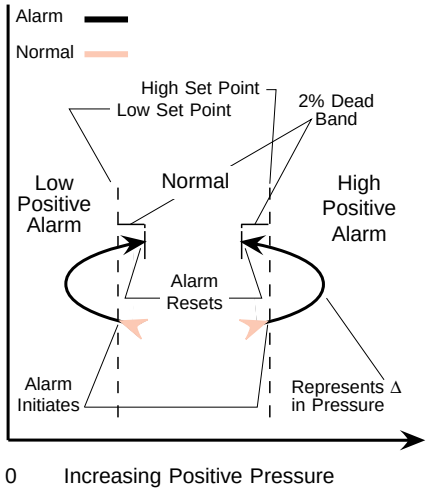
When a particular range of operation is set, operation is optimized over this range. All alarm settings are made throughout this range, and the 4-20mA output is proportional to this range. Figure 3-3 illustrates how the 4-20mA signal will vary if the operational range is set at -250 to +250 FPM.



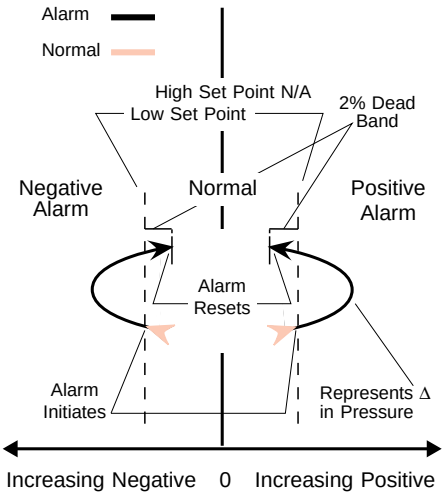
Measurement vs Output
Figure 3-3



Negative Polarity
Figure 3-4



Positive Polarity
Figure 3-5



Neutral Polarity
Figure 3-6

Alarm Limits - The point at which alarms activate and deactivate can be established by the user and changed if required. The alarm limits function differently, depending on the polarity selected. Alarm settings are made in the same units of measurement as those selected, either "wc or FPM. They are typically without sign, as their operation is a function of the polarity selected.

The alarm relay in the transmitter is normally energized when power is applied to the transmitter and no alarm condition exists. The occurrence of an alarm causes the alarm relay in the transmitter to deactivate. If a display is connected to the transmitter, the alarm light flashes and the horn sounds when the alarm occurs.

Where either positive or negative polarity has been selected, a high and low alarm level can be set. Both the high and low alarm settings are in relative, not absolute, terms. So, when the unit is set for negative polarity, a high alarm occurs when the space becomes excessively negative Refer to Figure 3-4. A low alarm occurs when the space pressure falls below the minimum negative pressure desired.

When the transmitter is set for neutral operation, the high alarm limit is not functional. The low limit becomes the limit for both the high and low pressure alarm points, generating an alarm if the pressure falls outside the window established by the limit. Figure 3-6 depicts the operation of the alarm comparisons.

When the transmitter is set for standby operation, the alarm comparison functions are not active, although the setpoints are still stored.

Alarm comparisons also have a dead band associated with them to prevent constant toggling on and off when the measurement is fluctuating around the alarm limit. This dead band is fixed at 2% of the selected full scale range of operation. Refer to figure 3-7 below.

Alarm Comparison
Figure 3-7

Full Scale Range	Min. Active Low Alarm	Alarm Dead Band
1000 fpm	15 fpm	20 fpm
500	8	10
250	3	5
100	2	2
0.1 in. H_2O	0.0012 in. H_2O	0.002 in. H_2O
0.01	0.0002	0.0002
0.005	0.00007	0.0001
0.001	0.00001	0.00002

Time Delay Period - Because people must move in and out of the space being monitored, it is not desirable to have an alarm action take place instantaneously. Typically, it takes a person a few seconds to open and close a door as they pass between two rooms. If they have equipment or carts, it may take even longer. To account for this, *ISO-TEK* has an adjustable time delay period which will delay the actuation of an alarm. When properly set, a person entering a room will not initiate an alarm, unless they leave the door open. The delay period is adjustable for 15, 30, 60, or 120 seconds.

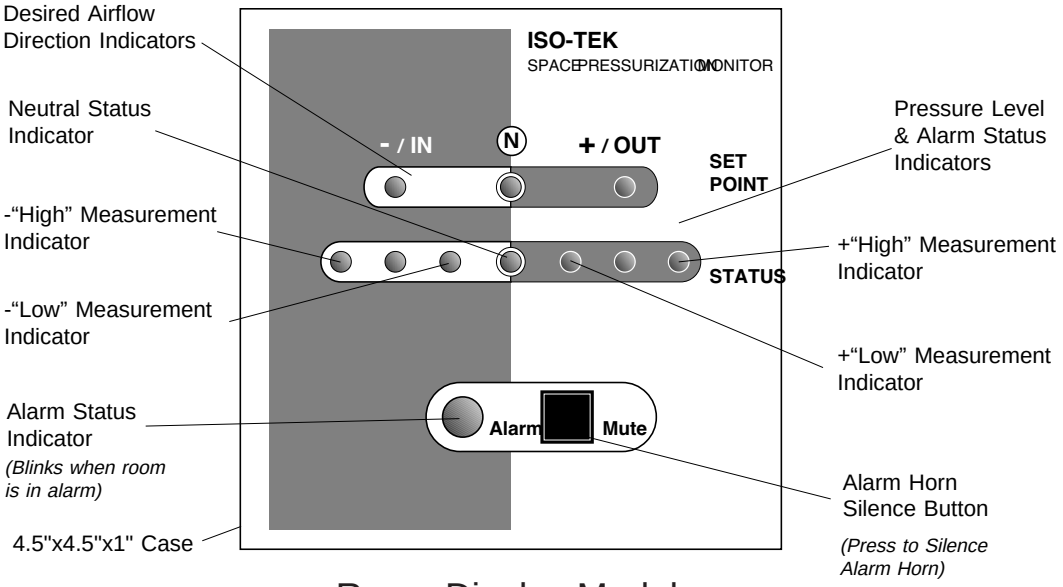
Alarm Latching - (Latching operation defines what happens to an alarm which occurred previously, after the condition which caused it has cleared, but before the occurrence of the alarm was acknowledged by the user.) In a non-latching operation, should the alarm clear, the alarm horn and relay output from the unit will be restored to the normal state. With latching operation, the horn will continue to sound, and the relay will stay in the alarm position until the alarm has been acknowledged by the user.

The alarm may be acknowledged either through the mute button on the *ISO-TEK* display or by a remote mute button wired to the transmitter input terminals. Latching operation should not be used if a display is not present or if the remote mute feature is not being used.

Deactivation of Audible Alarm - Where a display module is used, it may be desirable to deactivate the alarm horn built into the display. A common application would be in a patient isolation room where the transmitter is wired back to a nurses' station alarm panel. Activating the horn at the display might disturb the patient. Even with the horn deactivated, the local display will still provide the visual alarm indication required for the protection of staff.

Remote Polarity Setting or Muting - The *ISO-TEK* transmitter provides the capability of connecting external switches or buttons to remotely control how the unit operates. The transmitter can be configured so that wiring a multi-position switch to the remote selection inputs allows the external switch to index the desired polarity from another location. This is useful in applications where the room might be switched from negative pressure to positive pressure, depending on the requirements of the room. The unit can also be placed in the standby mode if desired.

The transmitter can also be configured so that wiring a momentary push button to one of the remote selection inputs provides a method to remotely silence the alarm horn or reset the alarm contacts. Refer to Chapter 1 for wiring details.



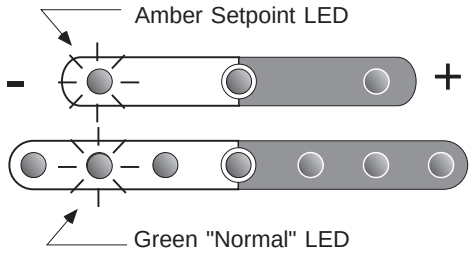
Room Display Module

Figure 3-8

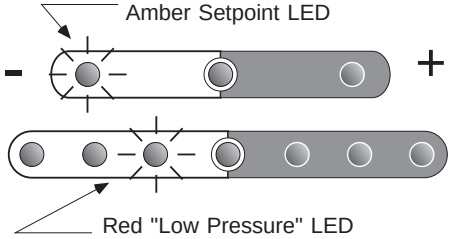
E. DISPLAY OPERATION

A display is normally used with the transmitter. Three amber "Set Point" indicators are provided on the display face, one of which will be lit based on the desired direction of airflow and pressurization level. The lit setpoint indicator will flash periodically to provide a visual indication that the monitor system is functioning properly. Refer to Figure 3-8 above.

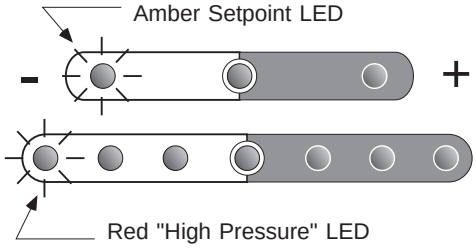
The "Status" indicators provide a visual indication of the level of pressurization. These dual colored, light emitting diodes (LEDs) indicate status with the color green for a normal condition and red for an alarm. When the pressurization level is normal, the green normal status indicator located directly under the yellow set point indicator will be lit. Should the pressure level decrease or increase outside of the preset alarm limits, the green indicator light will turn off, and the indicator to the left or right of the normal light will turn red accordingly. These indicator lights change immediately, in response to changes in space pressure. See Figure 3-9 and 3-10 for scenarios. The selected Full Scale Range for each room has a corresponding "Neutral Band". It is defined as ±10% of the full scale range around "0". The Status indicator in the center is the neutral indicator and will glow green when the room pressurization is in the neutral band, and within setpoint range; red when the pressurization is outside setpoint range, creating an alarm. See figure 3-10. If the high alarm setpoint is set to the maximum setting, the high alarm will be turned off. If the pressure exceeds the Full Scale Range the corresponding status indicator at either end of the display will glow green. (see scenario F, figure 3-9)



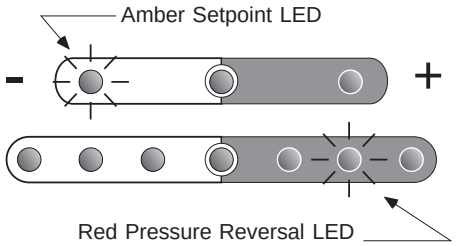
Scenario A: Negative Polarity, Normal pressure (Not in alarm)



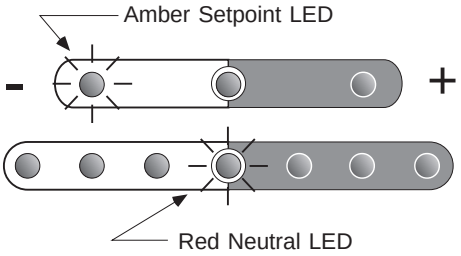
Scenario B: Negative Polarity, Insufficient Negative Pressure (in alarm)



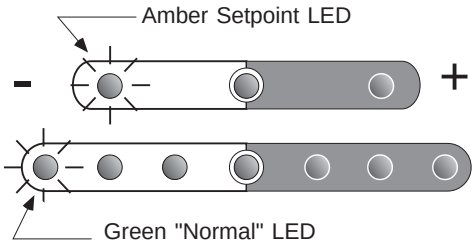
Scenario C: Negative Polarity, Excessive Negative Pressure (in alarm)



Scenario D: Negative Polarity, Positive Pressure (in alarm)



Scenario E: Negative Polarity, Neutral Pressure (in alarm)



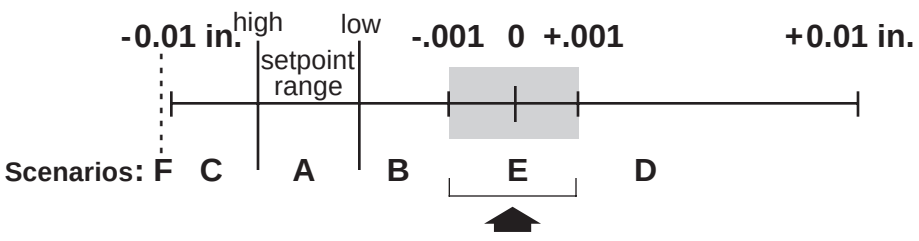
Scenario F: Negative Polarity, Exceeding low-end of Full Scale Range, High Alarm turned off (Not in alarm)

Status & Alarm LED Indicator Operation in Negative Polarity Setpoint Range

Figure 3-9

Note: Positive Polarity Scenarios would represent perfect mirror images of the above.

Pressure Range Visualization of Status Scenarios above



Note: Neutral Band for Full Scale Range of 0.01 in. H_2O

Full Scale Range	Neutral Band
1000 fpm	±100 fpm
500	±50
250	±25
100	±10
0.1 in. H_2O	±0.01 in. H_2O
0.01	±0.001
0.005	±0.0005
0.001	±0.0001

Neutral Light Operational Band

Figure 3-10

A large red LED alarm indicator is provided to display the presence of an alarm condition. This indicator flashes when an alarm condition has occurred for a length of time exceeding the preset time delay period. An audible alarm horn built into the display sounds in conjunction with the LED alarm indicator. When the alarm is acknowledged by pressing the MUTE button, the horn will silence and the LED alarm indicator will provide a steady red indication. This will continue as long as the alarm condition still exists.

All LED indicators are raised from the case slightly, to provide adequate viewing from any angle. The LED alarm indicator can be seen from fifty feet away, in normal ambient lighting conditions. This allows the display to be mounted in locations which are out of reach to those who would tamper with the unit.

Located on the rear of the display module are the configuration switches, the alarm adjustments, and the calibration adjustments. The use of these controls is detailed in Chapter 4 of this manual.

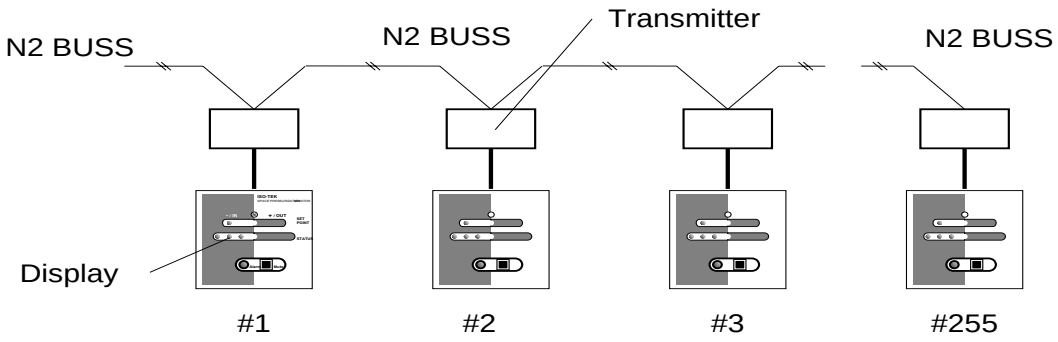
Note: Model SPM-2200 has an LCD for readout of inches WC or FPM, in 3 1/2 digit format. This is factory-set but can be field adjusted per section A, Chapter 2 under "Swiches A-4 and 5: Full Scale Range."

F. COMMUNICATIONS

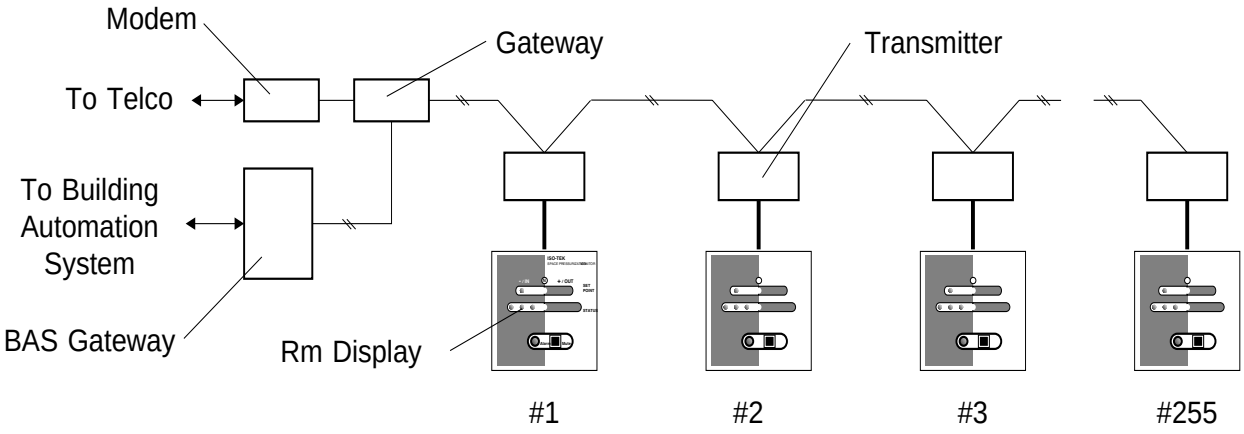
The SPM-2000 IsoTek transmitter is capable of digital communications on an RS 485, two conductor network cable at 9600 baud. Up to 255 units can be addressed on one network. Two communications protocols are available to the user: Tek-Air Open Protocol, and JCI N2 Protocol. In both cases, the SPM-2000 IsoTek can share the network with Tek-Air's FVC-2000plus Fume Hood Controllers of the same protocol. Open Protocol allows the SPM-2000 IsoTek Transmitter to interface the Honeywell Excel system.

Tek-Air will make the Open Communications Protocol available to any control system manufacturer.

Interfaces to Johnson Controls' Metasys™ system and Honeywell's Excel™ controller are just two of the several interfaces currently available. Tek-Air will make the communications protocol available to any control system manufacturer. Data communicated to the remote system includes: transfer air velocity, alarm setpoints, and alarm status. Parameters, which can be modified by the remote system, include: alarm setpoints, units of measurement, and airflow polarity. Details of specific communications methods are provided in supplemental instructions. Contact the factory or your Local Sales Representitive for these documents.



Typical JCI N2-Buss Network



Typical Communications Network to building automation system
(Via "Gateway" Protocol adapter)

Figure 3-11

SETUP AND ADJUSTMENT

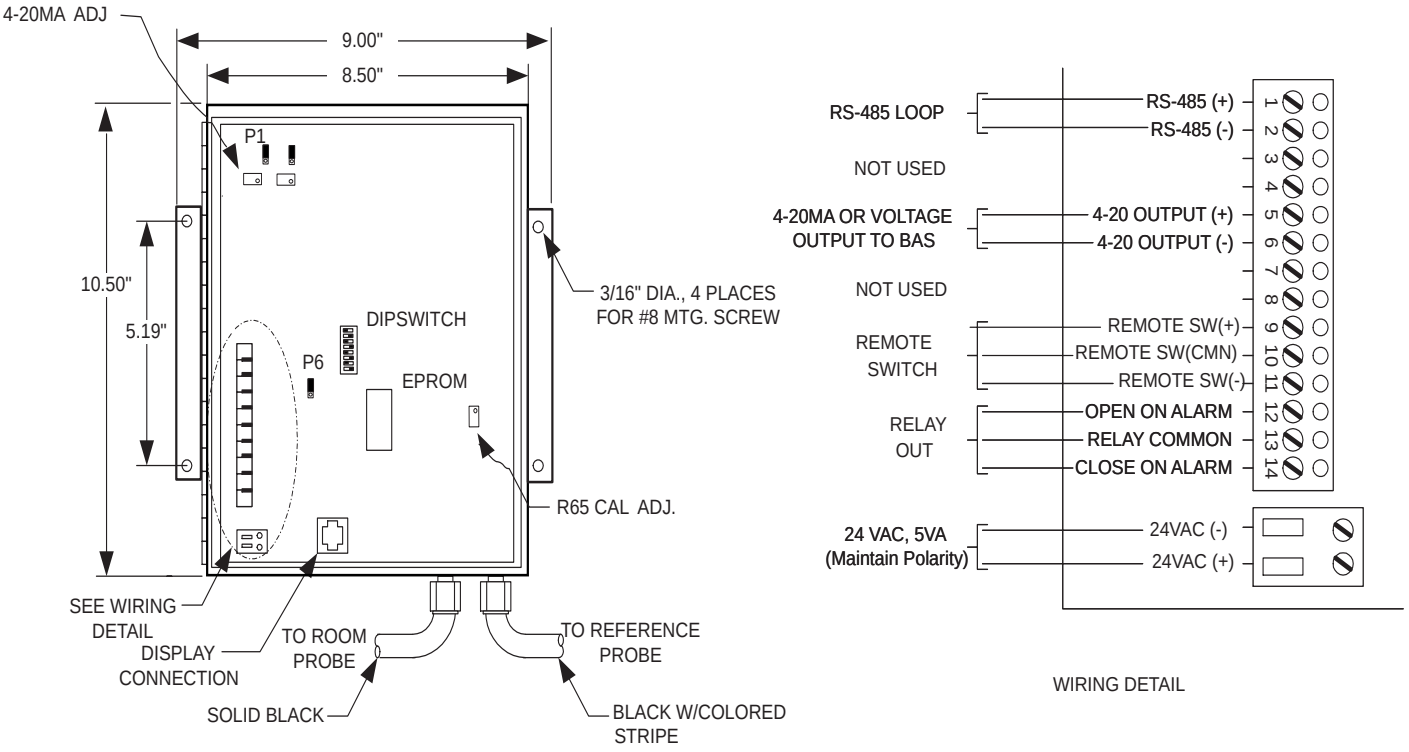
Warning: This product contains components that are Electrostatic Discharge Sensitive (ESD). Do not handle or remove the PCB assembly from the enclosure.

CHAPTER GOALS

This chapter provides the user with the information and methods required to start-up, configure, and tune the *ISO-TEK* system. This chapter should be read and understood prior to commissioning the unit. The chapter assumes that a model SPM-2100 with display has been provided. For setting up SPM-2000 units using either the SPM-7000 setup tool or communications software, refer to supplemental instructions provided with the unit.

A. POWER UP

Apply power to the transformer supplying 24 VAC to the transmitter. The *ISO-TEK* system should then become functional. Operation of the transmitter can be verified by observing the system status indicator located inside the transmitter, next to the transmitter address switch. Refer to Figure 4-1. When operating properly, this light emitting



Transmitter Board Layout

Figure 4-1

diode should flash on and off. If a display module is used, one of the three setpoint indicators (on the display) should be lit and should flash every few seconds.

If the unit does not power up properly and the transmitter indicator light does not light or flash, check for the presence of 24 VAC power on terminals @ J5. If power isn't present, troubleshoot the source of the problem. If 24VAC power is present, refer to the troubleshooting charts in Chapter 5.

It is possible that the transmitter will function properly but the room display module

switches are not set for "System Off", check all connections to verify that they are properly plugged in. Should there be a communications failure between the display module and the transmitter, all three setpoint indicators will flash. Refer to the troubleshooting guides in Chapter 5.

B. ESTABLISH CONFIGURATION PARAMETERS

Each *ISO-TEK* unit must be configured. Configuration is the process by which the user selects the features that are important for that particular application. It is through configuration that the operation of the system is customized for the needs of a particular facility.

With either an SPM-2000, SPM-2100 or SPM-2200, if the unit will utilize the communications capabilities to "talk" to a remote computer or building automation system, the address of each transmitter must be determined and set. The address is set to a number between 1 and 255 using the switches on the transmitter board. For complete instructions on setting these switches, (refer to supplemental instructions regarding communications) and to obtain the communications protocol, please contact the Tek-Air Service dept. at (203) 791-1400.

Prior to configuring the *ISO-TEK*, the user must answer the following questions. For a complete description of each of these configuration options, refer to Chapter 3, Section D, titled "Transmitter Functions."

- Do I want the polarity (negative, neutral, positive, or standby) of operation of the unit to be fixed, or selectable by a remote set of control contacts?

  ANSWER: ❒ FIXED ❒ REMOTE

- If the polarity is to be fixed, what is the normal (desired) polarity?

  ANSWER: ❒ NEGATIVE ❒ NEUTRAL ❒ POSITIVE.

- What units of measurement should the *ISO-TEK* use as a basis for operation? There is no standard regarding how this parameter should be set. In general, use the method which matches the output of the test instrument to be used to set up the room. If a thermal anemometer is used, select feet per minute. If a digital manometer is used, select inches of water. Because it incorporates the square root law, feet per minute generally provides better resolution over a wider range of operation.

  ANSWER: ❒ INCHES OF WATER ❒ FEET PER MINUTE

- How do I wish to use the alarm tone in the room display?

  ANSWER: ❒ ACTIVATE ❒ DISABLED

- Do I wish to have an alarm condition automatically reset the horn, light, and contacts when the alarm clears, or do I want to maintain the alarm condition until the alarm is acknowledged by pressing the mute button?

  ANSWER: ❒ AUTOMATIC RESET ❒ LATCH ALARM

- Is the unit going to operate at an altitude which is significantly above sea level?

  ANSWER: ❒ SEA LEVEL ❒ 1000' ❒ 2500' ❒ 5000'

The answers to the following questions may have to be determined after the unit is operating:

- What full scale range do I need? In general, select the smallest range which covers the range of pressures or flow velocities expected (or observed) to be encountered. Too large a range provides poor alarm and output resolution. Too small a range and space conditions may exceed the instrument's limits. 500 FPM is typical for hospital isolation rooms.

  ANSWER ("WC): ❒ .001" ❒ .005" ❒ .010" ❒ .100" OR
  ANSWER (FPM): ❒ 100 ❒ 250 ❒ 500 ❒ 1000

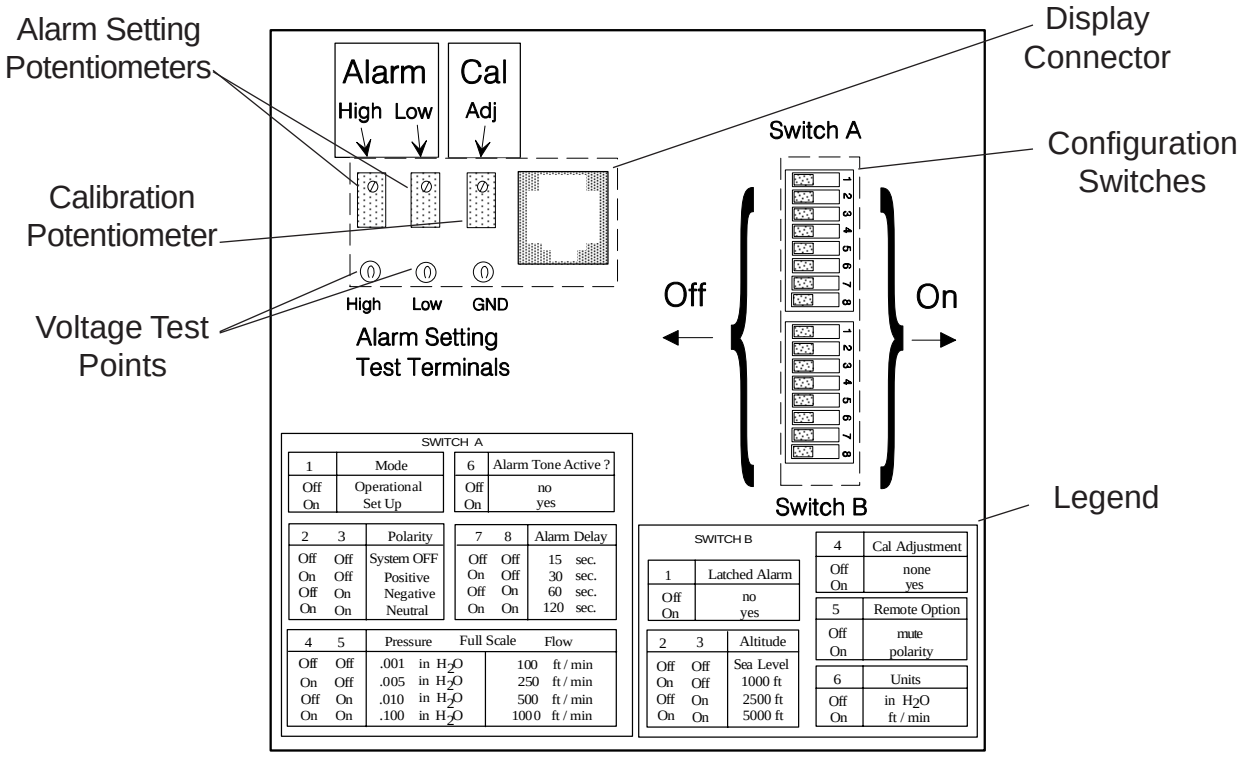
- What alarm delay period do I need? In general, start with the smallest delay period, then increase it if random alarms become a nuisance.

  ANSWER (SECONDS): ❒15 ❒ 30 ❒ 60 ❒ 120

C. SET CONFIGURATION PARAMETERS

With an SPM-2100, the configuration is performed by setting the position of sixteen programming switches, located on the rear of the display module. Refer to Figure 4-2. These switches are provided in two "DIP" (dual, in-line package) switch banks, marked "Switch A" and "Switch B." Switches are identified by bank and position number. Hence, the twelfth switch from the top is called B-4.

Starting with switch A, position 1, individually set the switches to establish the configuration settings determined previously. A worksheet documenting the factory established settings can be found on the inside of the transmitter enclosure door. Four blank columns are provided to document changes made by the user in the field.


Alarm Setting Potentiometers
Calibration Potentiometer
Voltage Test Points
Display Connector
Configuration Switches
Legend
Alarm
Cal
High Low
Adj
Switch A
Switch B
Off
On
High Low GND
Alarm Setting Test Terminals
SWITCH A
1 Mode: Off Operational, On Set Up
6 Alarm Tone Active ?: Off no, On yes
2 3 Polarity: Off Off System OFF; On Off Positive; Off On Negative; On On Neutral
7 8 Alarm Delay: Off Off 15 sec.; On Off 30 sec.; Off On 60 sec.; On On 120 sec.
4 5 Pressure Full Scale Flow: Off Off .001 in H2O 100 ft/min; On Off .005 in H2O 250 ft/min; Off On .010 in H2O 500 ft/min; On On .100 in H2O 1000 ft/min
SWITCH B
1 Latched Alarm: Off no, On yes
2 3 Altitude: Off Off Sea Level; On Off 1000 ft; Off On 2500 ft; On On 5000 ft
4 Cal Adjustment: Off none, On yes
5 Remote Option: Off mute, On polarity
6 Units: Off in H2O, On ft/min

Rear of Display Module
Figure 4-2

Two switch positions were not addressed previously in the section of this chapter titled "Establishing Configuration Settings" and these should be set initially as follows. Switch A, position 1, labeled "Mode" should be placed in the "Operational" position. Switch B, position 4, labeled "Cal Adjustment" should be placed in the "Off" position. The use of these switches will be covered later in this chapter.

D. CALIBRATION

The following paragraphs explain the method by which the *ISO-TEK* is calibrated. For a detailed description of how each of the alarm settings operates, refer to Chapter 3, section D.

Mode Selection - Calibration of alarm constants can be accomplished with switch A-1, set for either "Operational" or "Setup." In the setup mode, the transmitter operates normally, except that the time delay associated with alarm actuation is deactivated so that alarms come in immediately, as they occur.

Setting the Range - Initially set switches A-4 and A-5 for a full scale value of either .005 inches of water or 500 FPM, as these ranges encompass the pressure levels typically found in most rooms. Air-tight rooms may sustain higher pressures or velocities than leaky rooms.

Calibrating Alarm Parameters - Using a voltmeter, alarms are calibrated in the following manner. Having set each of the DIP switches listed above, note the settings for "Full Scale" range and "Units." Determine the "High Alarm" and "Low Alarm" settings to be used in the appropriate units. For positive and negative rooms using velocity, 100 FPM is a typical low alarm point and 225 a typical high point (unless the room is very tight.) A typical low setting using pressure is 0.001" and .004" a typical high setting. If the room is to be set for neutral pressurization, only the low alarm is active.

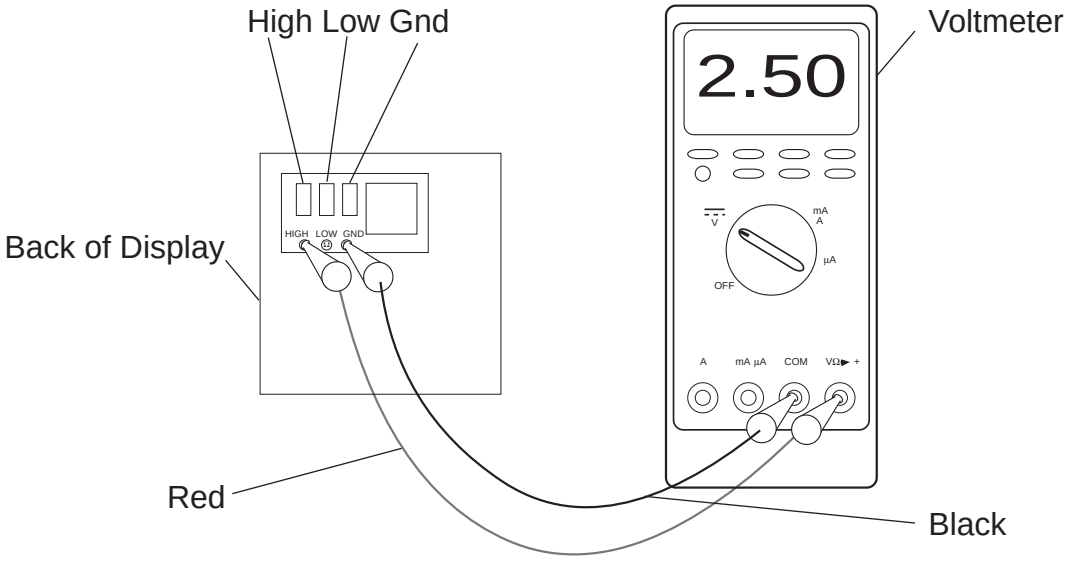
Determine the setup voltage from the Table 1 in Appendix A. As an example, find the voltage for 100 FPM with a full scale range of 500 FPM. From the table, find the 500 column in the "Feet per Minute Scales." Move down to find the low value of 100 FPM and note that 1.0 volt is shown in the "Alarm Voltage" column.

Determining the appropriate alarm voltage for neutral rooms differs from the negative and positive rooms in that only the low alarm setting is used. The low alarm setting then triggers an alarm on either side of the neutral point so, if the unit were calibrated for a low alarm of 150 FPM, any time the flow exceeded 150 FPM in either direction, the low alarm would trigger.

Connect the common lead of the voltmeter to the GND test point under the adjustment marked "Cal Adj" on the back of the display module. Refer to Figure 4-3 on the next page. Connect the plus lead of the voltmeter to the test point marked "Low." Set the voltmeter for DC volts and read the voltage. Adjust the potentiometer marked "Alarm Low", until the voltmeter reads the voltage indicated on the chart given the selected units and full scale.

To adjust the "High Alarm" setting, move the positive lead of the voltmeter to the test point marked "HIGH"." Set the voltmeter for DC volts and read the voltage. Adjust the potentiometer marked "Alarm High", until the voltmeter reads the voltage indicated on the chart, according to settings previously selected.

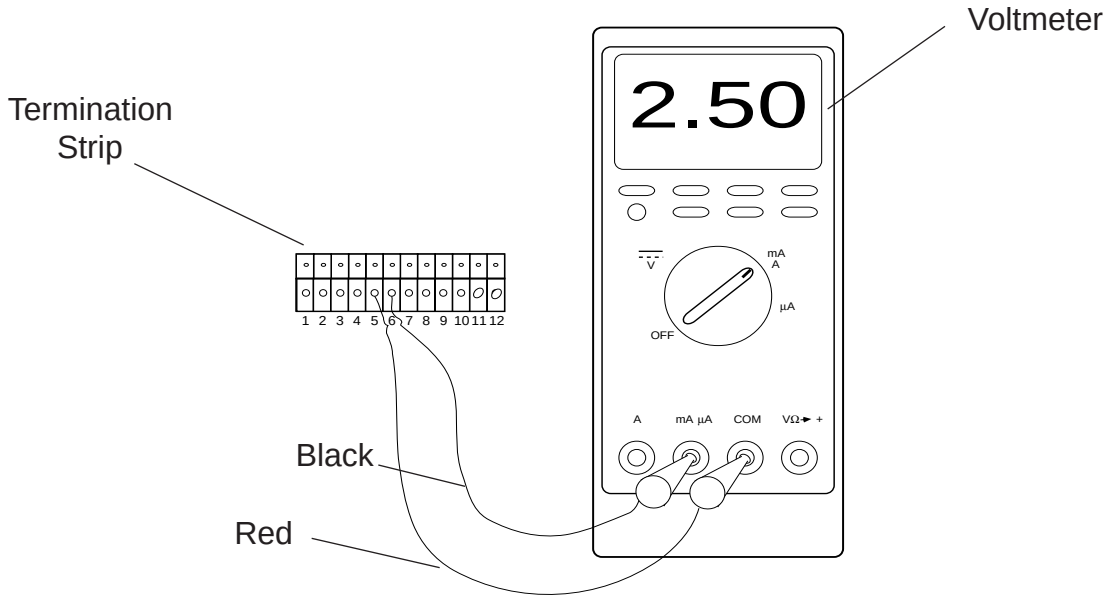
NOTE: *Either the high or low alarms can be deactivated by setting them at the limits of their adjustment. A low alarm setting will be deactivated if set to 0 volts and a "HIGH" alarm by setting to 5 volts. Should the alarm settings conflict (i.e. high is set lower than low), all status*



Voltmeter Connections for Alarm Voltages
Figure 4-3

and set point indicators will turn off and the alarm indicator will flash each half a second.

Determine Room Pressure - One of two methods may be used to determine the actual room pressure. The first method is preferred and utilizes the milliamp (mA) output of the transmitter. Again, note the "Units" and "Full Scale" configurations selected previously. With the digital voltmeter indexed to the current mode, place the positive lead across terminal 5 in the transmitter module and the negative lead on 6. Refer to Figure 4-4.



Voltmeter Connections for Output
Figure 4-4

Read the mA indicated by the voltmeter and, using the *Current : Negative and Current: Positive* columns in Appendix A, Table 1, determine either the feet per minute or the pressure.

The second method uses the alarm adjustment. To place the unit in the setup mode, set the "Mode" switch to "ON." Turn the high alarm adjustment fully clockwise. If the low alarm is active, turn the "Low Alarm" adjustment counterclockwise to lower the setpoint until the alarm clears. If the alarm is not active, turn the "Low Alarm" adjustment clockwise, until the alarm horn activates. With a voltmeter connected as in Figure 4-3, measure the voltage between the GND and "LOW" test points. To determine either the FPM or "wc that the room is pressurized to, use the appropriate Units and Full Scale configurations, compare this voltage to chart in appendix "A". ***CAUTION:*** *when finished, remember to set the "Low Alarm" alarm adjustment back to the desired voltage, and return the "Mode" switch to "Operational."*

Adjust the Transmitter Zero Point - The 4-20 mA output from the transmitter is factory calibrated to operate over the full scale range selected. Four (4) mA is the negative full scale value, twenty (20) represents the positive full scale value, and twelve represents zero (neutral). These calibration constants are set in the microprocessor of the transmitter circuit board.

Occasionally it may be required to trim the signal to match the requirements of a particular type of input device (indicator, controller, recorder, etc.) This can be accomplished by using the potentiometer marked "4mA Adjust", located on the circuit board. Refer to Figure 4-1. To make this adjustment active however, the jumper labeled "P1", which is normally between pins 1 and 2, must be moved to pins 2 and 3.

The "4mA Adjust" potentiometer will add or subtract a fixed current offset to the output of the transmitter and has no effect on the transmitter span. It can be used to adjust to the 12mA value with the pressure inputs to the transmitter closed off (put masking tape over both the high and low pressure input fittings on the transmitter to insure they are not affected by breezes in the area of the transmitter; Both fittings must be fully sealed!).

Adjust the Transmitter Calibration - This feature is more applicable to units set to indicate in FPM as there is a greater chance that some difference will occur between the reading from a thermal anemometer and the *ISO-TEK* unit. This is because the FPM of flow between two rooms is a function of the differential pressure between them and the area of crack space through which the air flows.

As the ratio of room space to crack space differs from room to room, the "flow coefficient" may differ also. In most cases, because the crack area is so small compared to the room area, the coefficient is very predictable and this is what the factory setting is based on. But in some cases, the user may find differences between what the unit reads and what a thermal anemometer placed under the door reads.

CAUTION: *Using thermal anemometers properly requires care, skill, and the proper technique. At low flows these instruments are typically no better than ±10% of reading. Therefore, a calibration adjustment should not be made to trim slight variations (within ±10%) between devices.*

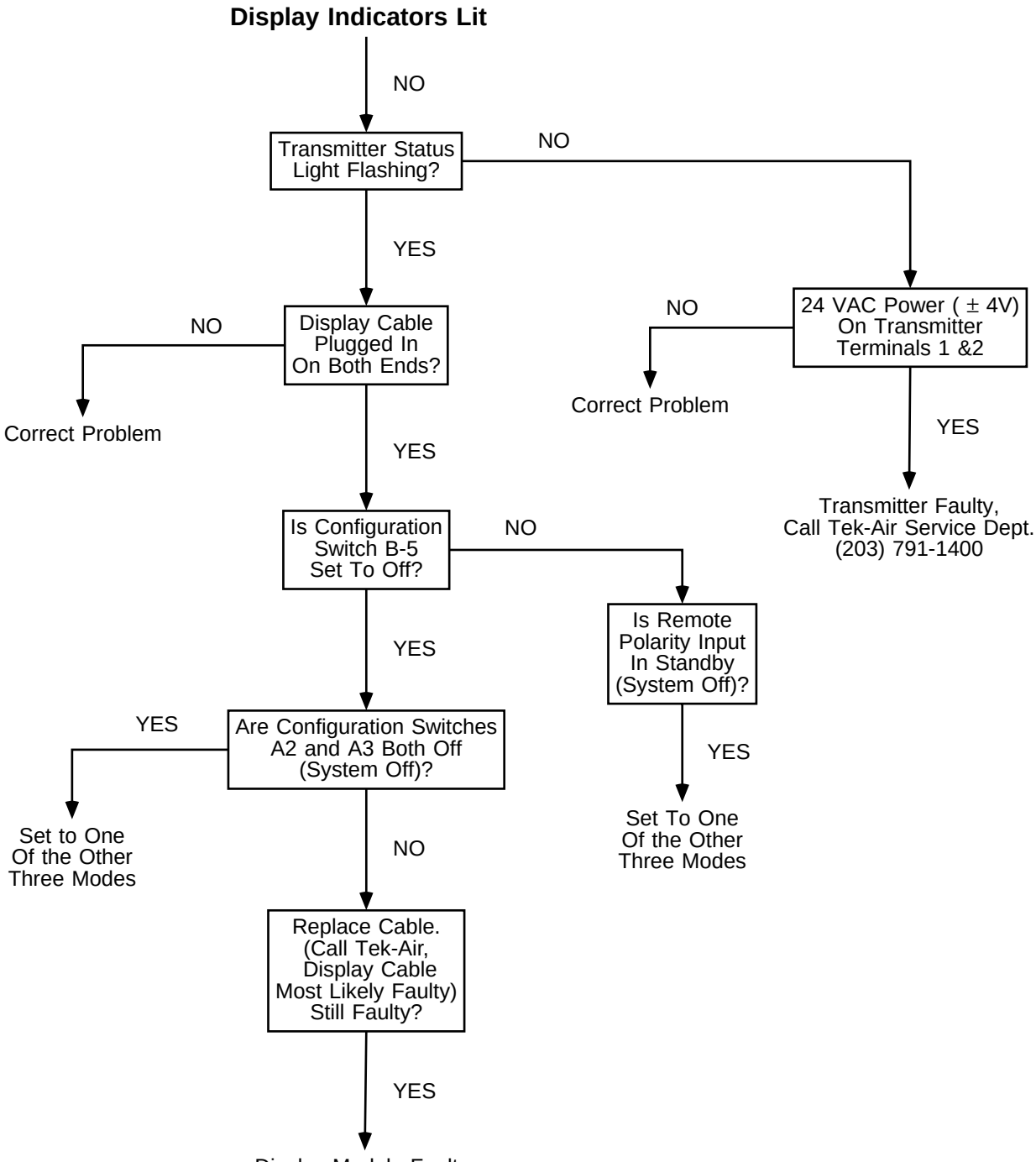
To compensate for this difference, set switch B-4 labeled "Cal Adjustment" to "YES" to activate the calibration adjustment potentiometer. This adjustment can then be rotated in either direction, until the mA output of the unit agrees with the thermal anemometer. Refer to Appendix A, Table 1.

CAUTION: *When the calibration is complete, the switch should be left in the "YES" position. Returning it to "NO" will deactivate the adjustment made.*

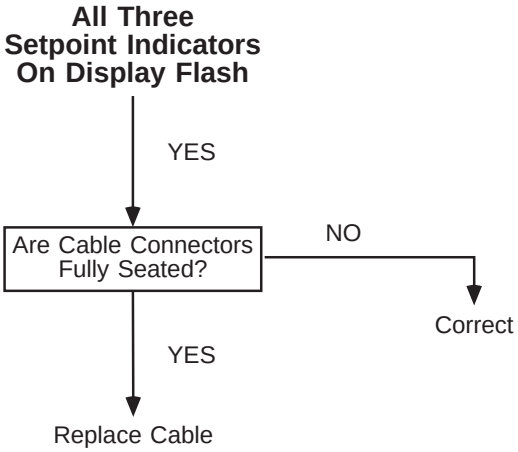
NOTE: On Model 2200, the LCD indicator range must match this range. If not, the zero and span pots on the LCD can be used to match the display to the selected transmitter range. A 4-20 mA generator can be used to drive the LCD by disconnecting the LCD + and - wires from the transmitter and connecting the generator in its place. At 4 mA, the display must read the appropriate minimum value, if not, adjust the Zero pot. At 20 mA, the display must read the appropriate Full Scale value, if not, adjust the Span pot. Re-connect the transmitter to the LCD when finished.

TROUBLESHOOTING

I. DISPLAY DOES NOT WORK


Display Indicators Lit
NO
Transmitter Status Light Flashing?
NO
YES
Display Cable Plugged In On Both Ends?
NO
Correct Problem
24 VAC Power (± 4V) On Transmitter Terminals 1 &2
NO
Correct Problem
YES
Transmitter Faulty, Call Tek-Air Service Dept. (203) 791-1400
YES
Is Configuration Switch B-5 Set To Off?
NO
Is Remote Polarity Input In Standby (System Off)?
YES
Set To One Of the Other Three Modes
YES
Are Configuration Switches A2 and A3 Both Off (System Off)?
YES
Set to One Of the Other Three Modes
NO
Replace Cable. (Call Tek-Air, Display Cable Most Likely Faulty) Still Faulty?
YES
Display Module Faulty, Contact Tek-Air Service Department (203) 791-1400
Have the following information available:
• Switch settings used
• Condition of display lights
• Observed pressure or FPM
• Observed direction of airflow
• High and Low Alarm settings in volts
• Observed 4-20mA reading
• Software version from transmitter
• Tek-Air job #, facility name and location

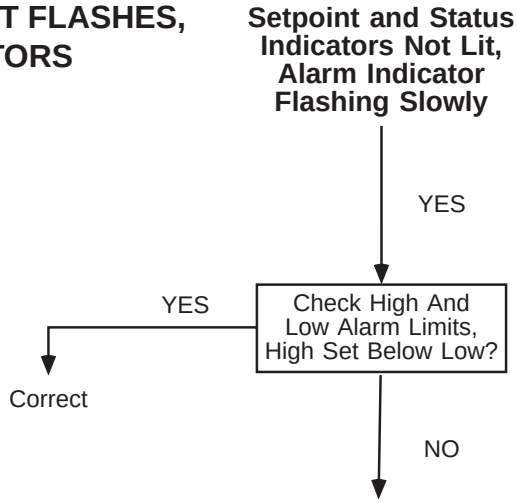
II. SETPOINT INDICATORS FLASH



Call Tek-Air Service Department
(203) 791-1400

Have the following information available:
- Switch settings used
- Condition of display lights
- Observed pressure or FPM
- Observed direction of airflow
- High and Low Alarm settings in volts
- Observed 4-20mA reading
- Software version from transmitter
- Tek-Air job #, facility name and location

III. ALARM LIGHT FLASHES, OTHER INDICATORS ARE OFF


Setpoint and Status Indicators Not Lit, Alarm Indicator Flashing Slowly
YES
YES
Check High And Low Alarm Limits, High Set Below Low?
Correct
NO

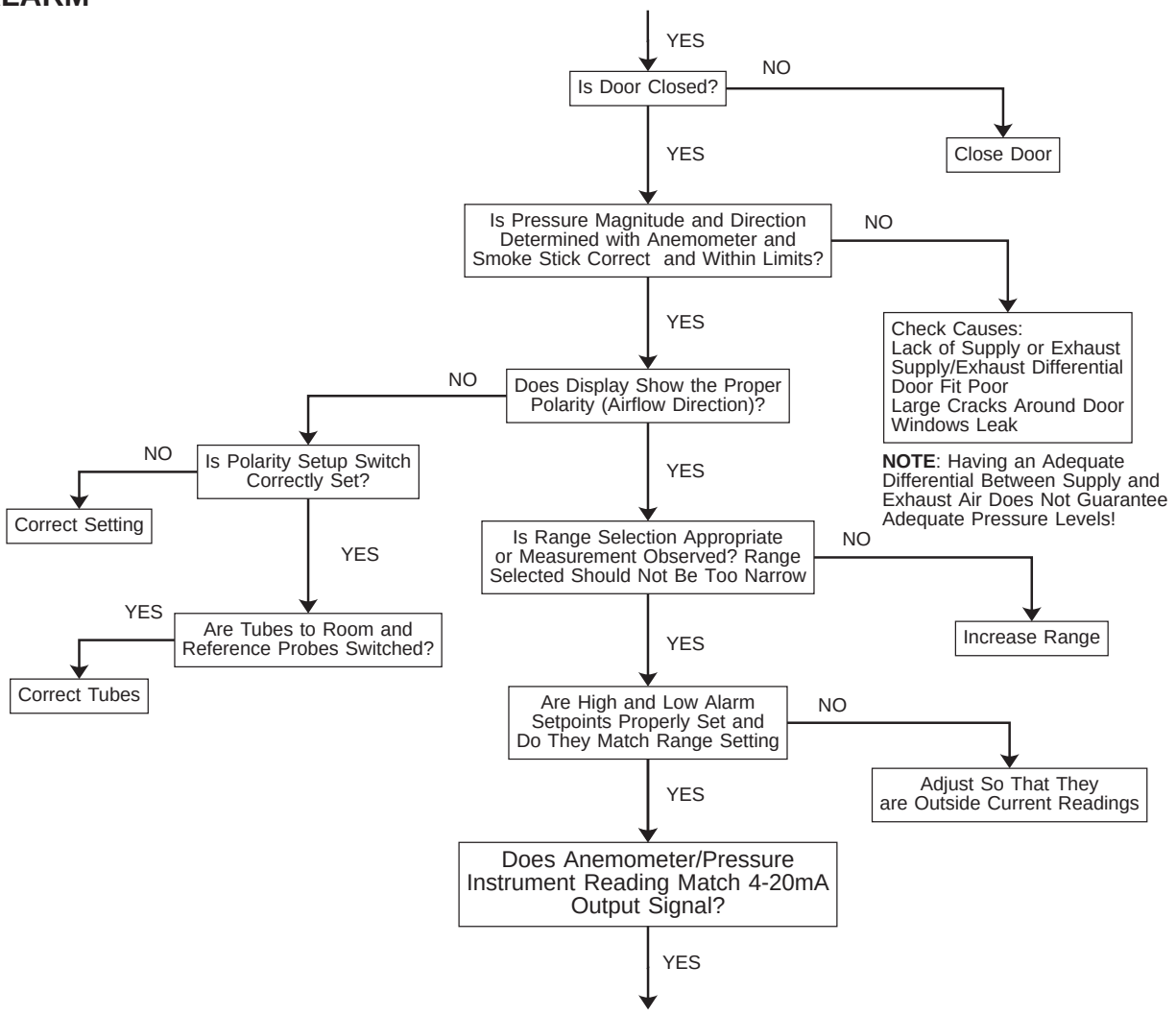
Call Tek-Air Service Department
(203) 791-1400

Have the following information available:
- Switch settings used
- Condition of display lights
- Observed pressure or FPM
- Observed direction of airflow
- High and Low Alarm settings in volts
- Observed 4-20mA reading
- Software version from transmitter
- Tek-Air job #, facility name and locatic

IV. ALL STATUS INDICATORS FLASH RED AND ALARM HORN SOUNDS

Check Sum Error
Contact Tek-Air Service Department at (203) 791-1400

V. UNIT IS ALWAYS IN ALARM



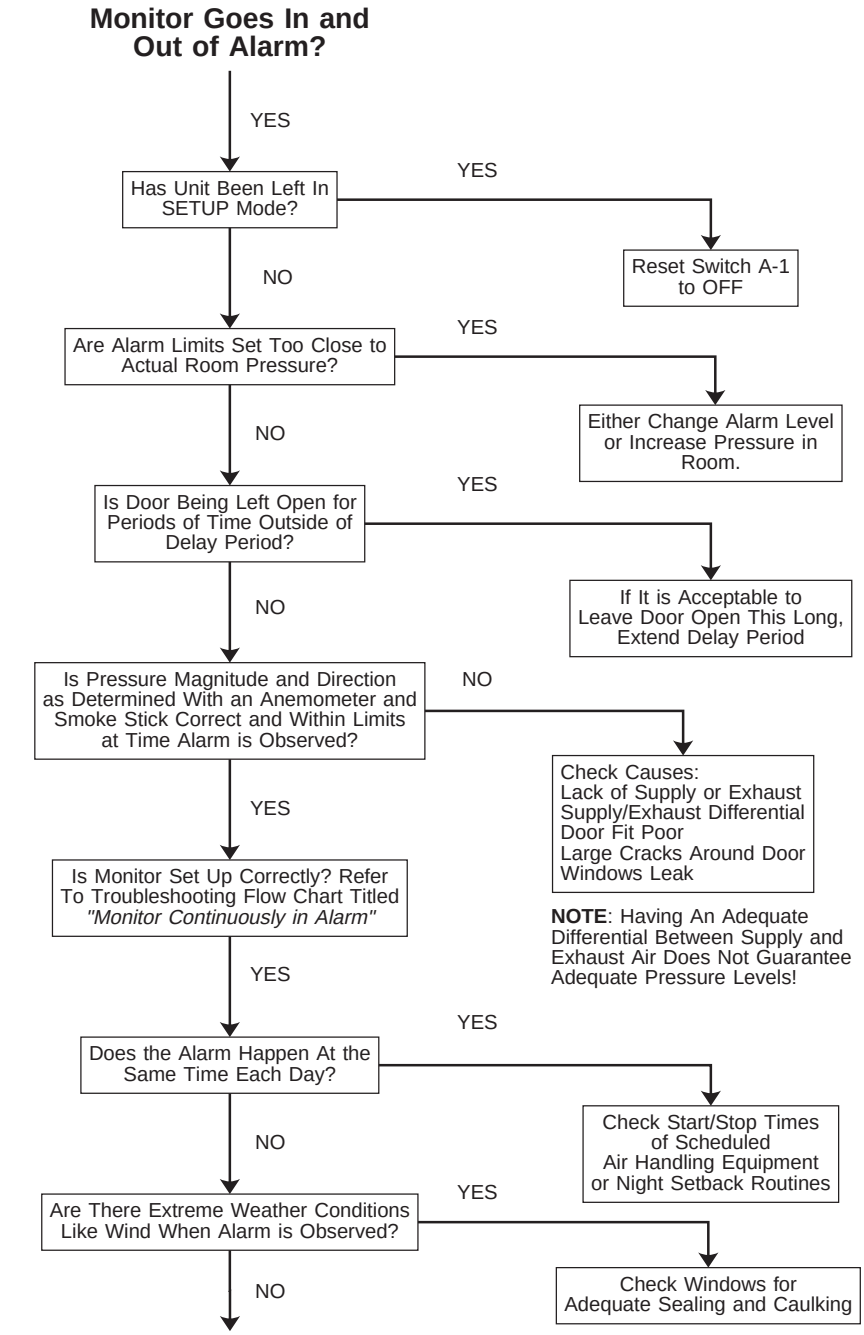
NOTE: Having an Adequate Differential Between Supply and Exhaust Air Does Not Guarantee Adequate Pressure Levels!

Contact Tek-Air Service Department
(203) 791-1400

Have the following information available:

- Switch settings used
- Condition of display lights
- Observed pressure or FPM
- Observed direction of airflow
- High and Low Alarm settings in volts
- Observed 4-20mA reading
- Software version from transmitter
- Tek-Air job #, facility name and location

VI. UNIT GOES IN AND OUT OF ALARM CONSTANTLY


Monitor Goes In and Out of Alarm?
YES
Has Unit Been Left In SETUP Mode?
YES
Reset Switch A-1 to OFF
NO
Are Alarm Limits Set Too Close to Actual Room Pressure?
YES
Either Change Alarm Level or Increase Pressure in Room.
NO
Is Door Being Left Open for Periods of Time Outside of Delay Period?
YES
If It is Acceptable to Leave Door Open This Long, Extend Delay Period
NO
Is Pressure Magnitude and Direction as Determined With an Anemometer and Smoke Stick Correct and Within Limits at Time Alarm is Observed?
NO
Check Causes:
Lack of Supply or Exhaust
Supply/Exhaust Differential
Door Fit Poor
Large Cracks Around Door
Windows Leak
YES
Is Monitor Set Up Correctly? Refer To Troubleshooting Flow Chart Titled "Monitor Continuously in Alarm"
NOTE: Having An Adequate Differential Between Supply and Exhaust Air Does Not Guarantee Adequate Pressure Levels!
YES
Does the Alarm Happen At the Same Time Each Day?
YES
Check Start/Stop Times of Scheduled Air Handling Equipment or Night Setback Routines
NO
Are There Extreme Weather Conditions Like Wind When Alarm is Observed?
YES
Check Windows for Adequate Sealing and Caulking
NO

Contact Tek-Air Service Department

(203) 791-1400

Have the following information available:

- Switch settings used
- Condition of display lights
- Observed pressure or FPM
- Observed direction of airflow
- High and Low Alarm settings in volts
- Observed 4-20mA reading
- Software version from transmitter
- Tek-Air job #, facility name and location

APPENDIX A: SETUP VOLTAGE CHARTS

DVM Readings			Feet per Minute Scales				Inches Water Scales			
Alarm Voltage	Current; Negative	Current; Positive	100	250	500	1000	0.001	0.005	0.01	0.1
0.00	12.00	12.00	0	0	0	0	0.00000	0.00000	0.0000	0.0000
0.25	11.60	12.40	5	13	25	50	N/A	0.00025	0.0005	0.0050
0.50	11.20	12.80	10	25	50	100	0.00010	0.00050	0.0010	0.0100
0.75	10.80	13.20	15	38	75	150	0.00015	0.00075	0.0015	0.0150
1.00	10.40	13.60	20	50	100	200	0.00020	0.00100	0.0020	0.0200
1.25	10.00	14.00	25	63	125	250	0.00025	0.00125	0.0025	0.0250
1.50	9.60	14.40	30	75	150	300	0.00030	0.00150	0.0030	0.0300
1.75	9.20	14.80	35	88	175	350	0.00035	0.00175	0.0035	0.0350
2.00	8.80	15.20	40	100	200	400	0.00040	0.00200	0.0040	0.0400
2.25	8.40	15.60	45	113	225	450	0.00045	0.00225	0.0045	0.0450
2.50	8.00	16.00	50	125	250	500	0.00050	0.00250	0.0050	0.0500
2.75	7.60	16.40	55	138	275	550	0.00055	0.00275	0.0055	0.0550
3.00	7.20	16.80	60	150	300	600	0.00060	0.00300	0.0060	0.0600
3.25	6.80	17.20	65	163	325	650	0.00065	0.00325	0.0065	0.0650
3.50	6.40	17.60	70	175	350	700	0.00070	0.00350	0.0070	0.0700
3.75	6.00	18.00	75	188	375	750	0.00075	0.00375	0.0075	0.0750
4.00	5.60	18.40	80	200	400	800	0.00080	0.00400	0.0080	0.0800
4.25	5.20	18.80	85	213	425	850	0.00085	0.00425	0.0085	0.0850
4.50	4.80	19.20	90	225	450	900	0.00090	0.00450	0.0090	0.0900
4.75	4.40	19.60	95	238	475	950	0.00095	0.00475	0.0095	0.0950
5.00	4.00	20.00	100	250	500	1000	0.00100	0.00500	0.0100	0.1000

CAUTION: *The high or low alarms can be deactivated by setting them at the limits of their adjustment. A low alarm setting will be deactivated if set to 0 volts and a "HIGH" alarm by setting to 5 volts. Should the alarm settings conflict (i.e. high is set lower than low), all status and set point indicators will turn off and the alarm indicator will flash each half a second.*

APPENDIX B:APPLICATION OF ISO-TEK TO NEGATIVE PRESSURE ISOLATION ROOMS WITH ANTEROOMS

CHAPTER GOALS

In many instances, negative pressure isolation rooms incorporate an anteroom to serve as an airlock between the room and the hallway. Given the presence of an anteroom, the question arises, where do I mount the reference probe, in the hallway or in the anteroom? The problem is further complicated by the fact that the interpretation of some local codes may lead the user to believe that the reference probe must be located in the anteroom.

A. UNDERSTANDING ANTEROOMS

Anterooms, like their airlock counterpart in a clean room, are designed to provide an additional barrier to the transfer of contaminants between the isolation room and the corridor. Typically, an anteroom is pressurized to a level which is higher than the level of the isolation room and the adjacent hallway. Additionally, one anteroom may serve two or more isolation rooms.

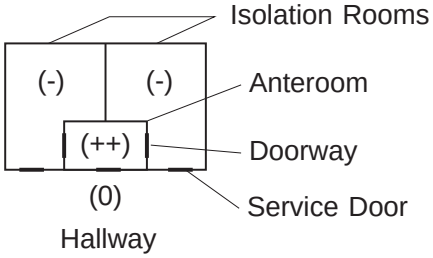
Because anterooms are generally small and have significantly fewer leaks than the isolation rooms they serve, they can usually be pressurized to a greater extent than the isolation rooms. The result is that getting a high positive pressure difference between the anteroom and the isolation room is far easier than getting a high difference between the isolation room and the corridor. However, because of its small size and relatively high airflow, the pressure in the anteroom tends to fluctuate to a greater extent than in an isolation room.

The leaks between the isolation room and the adjacent areas (hallway, adjacent rooms, etc.) don't occur just at the entry door to the room, they also occur at electrical outlet cutouts, service doors, ceiling cavities, mechanical and electrical chases, and at windows. The anteroom only assists in providing a reduction in the movement of air as a person moves from the hallway and the isolation room or vice-versa.

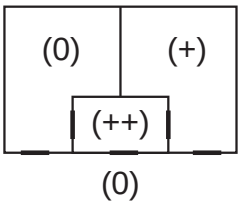
B. APPLICATION OF ISO-TEK

ISO-TEK measures the differential pressure between two spaces. These spaces could be the isolation room and the hallway, or the isolation room and the anteroom. Tek-Air strongly suggests that the isolation room be referenced to the hallway, as illustrated below.

The following examples assume that the alarms are calibrated for a differential of .001"wc, as proposed by the CDC, and the anteroom is highly pressurized. Relative pressure levels are shown by (-), negative in the area of -.002"wc; (0), neutral; (+), positive in the area of +.002"wc; (++) positive in the area of +.004"wc or greater.

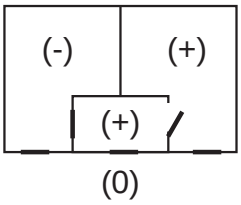


With the doors closed, a monitor referenced to the anteroom shows no alarm condition. In fact, the room would be safe and isolating properly.

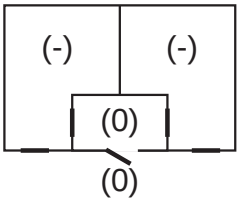


With the doors closed and pressure levels in the isolation room at neutral or at a slight positive, a monitor referenced to the anteroom would not show an alarm, yet air could be transferred out, into the hallway through the cracks around the service doors because of insufficient differential between the isolation room and the hallway.

The following examples assume that the anteroom is used as the reference and the low alarms are calibrated for a minimum differential (.004"), just .002"wc below the normal differential of .006"wc between the anteroom and the hallway.



With the door between the anteroom and one of the isolation rooms open, the rightmost isolation room pressure rises and the anteroom pressure falls. Although the leftmost room is safe, both isolation rooms go into alarm.



With the anteroom door to the hall open the anteroom pressure falls to neutral. Although they are both safe, both isolation rooms go into alarm.

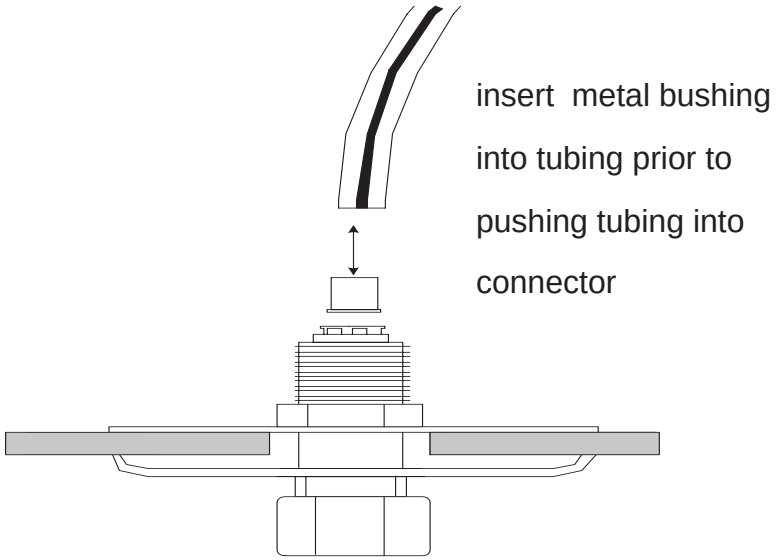
C. RECOMMENDATIONS

Tek-Air recommends that the isolation room pressure be referenced to the hallway and not the anteroom. If the isolation room must be referenced to the anteroom, we suggest that alarms be set for the CDC suggested limit of .001"wc and a differential not much higher. Set up and test the monitor with the anteroom door to the hallway open.

Warning: If both rooms are monitored by SPM-2000,SPM-2100 or SPM-2200, a common reference probe cannot be used! Each monitor must have its own reference.

APPENDIX C:INSTALLATION OF OPTIONAL CEILING-MOUNTED ROOM AND REFERENCE PROBES

Note: Prior to the issuance of CDC Guidelines for isolation room monitoring and control in October, 1994, Tek-Air Systems furnished ceiling-mounted room and reference probes with all *ISO-TEK* systems. At present all systems are shipped with wall-mounted probes. Ceiling probes are available as an option and must be specially ordered.



Room and Reference Probe Installation
Figure A-1

Locate and Mount Room Probe and Reference Probe - Each probe consists of a white nylon Quick-disconnect fitting with a filtered inlet on one end, and two stainless steel trim plates. Standard 1/2" OD diameter tubing is utilized to connect the probes to the transmitter enclosure and can be purchased from Tek-Air. Refer to Figure A-1.

Each probe is normally installed in the ceiling tile, one in the corridor (reference), and one in the room to be measured. Tek-Air does not normally recommend mounting the reference probe in an anteroom. Refer to Appendix B for technical explanation. Probes should be mounted several feet from any sources of air turbulence such as registers, grilles, or diffusers. The length of tubing used to connect each sensor need not be the same, but the combined length of tubing should not exceed 50 feet. *CAUTION: Reference probes must not be shared between multiple ISO-TEKS. Metal inserts must be pushed into the tubing before tubing is inserted into fitting.*

Remove the ceiling tile where the probe is to be installed. A one inch diameter hole should be made in the center of the tile. Remove the fitting and jam nut, and one trim plate from the fitting. From the unfinished side of the tile, push the threaded end of the fitting through the hole. Reinstall the trim plate and finger tighten the jam nut until the probe is secure. Then insert the tubing into the fitting and place the ceiling tile into the ceiling grid.

APPENDIX D: DISPLAY/TRANSMITTER SOFTWARE COMPATIBILITY

WARNING

Display and Transmitter
Software Version Compatibility
Are Important!

The standard SPM-2100 display, transmitter and tool are microprocessor based products and require that their software version levels be compatible in order to function properly. Software version updates are generally provided to incorporate feature enhancements in the product.

The version number for the transmitter can be determined by opening the transmitter cover and looking at the tag on an electronic chip located in close proximity to the flashing activity indicator (see figure 4-1). The software version of the display can be found in the upper right-hand corner of the rear of the display (see figure 2-1).

Incompatibility of software versions should only be a problem in situations where spare displays and transmitters are stocked as repair parts, or where a customer has several generations of product in his facility. In situations where an incompatibility exists, either the display or the transmitter program chip can be changed to match the version of it's companion part. It is generally simpler to replace the display chip because the transmitter typically must be recalibrated after a change. Contact Tek-Air Service if you suspect an incompatibility problem.

The following software versions must be used together:

Product Series	Transmitter	Display	Release Date	Tool
SPM-5000	B.2	B.0	1/26/94	N/A
SPM-5000	B.43	B.1	2/16/94	N/A
SPM-5000	B.51	B.2	3/23/94	N/A
SPM-5000	B.61	B.2	4/8/94	N/A
SPM-5000	C.60	C.3	6/22/94	B.04
SPM-5000	C.14	C.4	2/12/95	B.06
SPM-5000	C.18	C.4	5/19/95	B.08
SPM-5000	D.00	C.4	12/1/95	B.09
SPM-5000	D.02	C.4	8/15/96	B.09
SPM-5000	D.02	C.4	9/10/96	B.10
SPM-5000	D.02	C.4	12/14/98	B.11
SPM-5000	D.02	C.5	4/20/99	B.11
SPM-2000	E.15	C.5	12/1/99	B.11

APPENDIX E: COMMUNICATION TRANSFER VARIABLES FOR TEK-AIR OPEN PROTOCOL.

Parameters available for communication to a host system.

TV#	Read or Write	Description
0	R	Room air pressure or velocity; -1000(.1) to + 1000(.1) is 0 to 4095 counts (2047counts= neutral)
1	-	Pressure or velocity set point; scaled same as 0 (reserved for future controller)
2	-	Controller output; 0 to 100% is 0 to 4095 counts (reserved for future controller)
3	R/W	High transfer Alarm set point; scaled the same as 0
4	R/W	Low transfer alarm set point; scaled the same as 0
5	R	High transfer Alarm; 1 is alarm, 0 is not in alarm
6	R	Low transfer Alarm; 1 is alarm, 0 is not in alarm
7	R	System condition; 0 is OK, 1 is invalid Alarm limits, 2 is hardware malfunction, 4 is communication loss to display, 8 is checksum error
8	R/W	Local alarm acknowledge; 0 is normal, 1 is not acknowledged
9	R/W	Remote alarm horn disable; 0 is horn enabled, 1 is horn disabled
10	R/W	Configuration setup; a four digit code - see explanation below
11	R/W	Alarm time delay; 0 to 4095 seconds is 0 to 4095 counts
12	-	Not used
13	R	Communications status; 0 is normal, 1 to 255 is the number of failed attempts

Configuration Setup details:
A four digit code defining the setup of the monitor.

Thousands digit:	**Polarity**	1; positive	2 ; negative	3; neutral	0; standby/off
Hundreds digit:	**Full Scale**	1; 100 fpm, .001 in H2O	2; 250 fpm, .005 in H2O	3; 500 fpm, .01 in H2O	4; 1000 fpm, .1 in H2O
Ten digit:	**Acknowledge Function**	0; is not latched	1; is latched		
Ones digit:	**Units**	0; in H20 1; fpm			

The monitor can be connected to a Gateway in parallel with FVC-2000's.

Note 1: Setting the hi alarm limit to the value equivalent to or above the full scale magnitude, or setting the low alarm limit to 2047, will disable the alarm feature

Note 2: In order to Write an acknowledge to Transfer Variable #8, a “1” must be written. This will be read back as a “0”. This location should then immediately be written with a “0” to prepare for the next alarm event. The acknowledge will continue to be reported correctly as a “0” until the alarm condition clears.

Note 3: To operate as a Transmitter only (no display), the Monitor must be in ‘Display Override’- this operating configuration is factory set per model code ordered (SPM- 2000). Configured this way, the monitor still could have an IMD-5000 Mini Display connected, or even a full Display (like SPM-2100). (However, while the Transmitter will continue to ‘write’ to a full Display, it will not ‘read’ configuration information from it.)

Note 3: Although Transfer Variable #9 seems to make sense only when a Display is attached, it is read/write in Display Override mode in the event the user decides to attach a display. Be cause the Transmitter does not read from the Display, this Transfer Variable provides a method to enable or disable the alarm tone which can be activated on the Display in an alarm condition.

Note 4: The Acknowledge Function (tens digit) of the configuration code allows the user to write to the alarm latching feature. When the code is read, the digit will indicate whether or not an alarm is currently latched.

APPENDIX F: N2 COMMUNICATIONS

Conditions which should be understood prior to the commisioning of communications to the Iso-Tek SPM-2000 series product.

1. When the unit is set for "OFF" or setup modes of operation the N2 status attribute could indicate that the AI-1 point (transfer velocity) is unreliable. Presently this AI-1 indicates this condition only during EEPROM fault or loss of A/D converter reference voltage.

    - ♦ The unit will only be in this condition when the unit is not in the normal operating condition i.e. in setup mode or during the changing of the configuration. this condition is a maintainence mode. Any communications between the unit and the BMS should be considered as such until the user has completed the changes and the BMS has recieved the updated or refreshed data.

2. The Iso-Tek specification indicates for the configuration setup transfer variable which controls units a value of 1 indicates FPM and a value of 0 is invalid.

    - ♦ The current firmwareallows a value of zero to be written to this transfer variable however all readings reported over the network (N2 and Open) continue to indicate in units of FPM.

3. Alarm Latching Affects reported BI alarms/status indications:

    - ♦ This feature can lead to some confusing indications from the N2 variables. To understand the behavior it is first necessary to know the alarm violation status is reported in two places. First AI-1 (room air transfer) has a status attribute with bits for indicating hi/lo alarm violations. Second, BI-1 and BI-2 are individual indications of the alarm violation status. The BI parameters are the simplest to understand. If an alarm violations occursand alarm latching is on, the associated BI will change to active (1) to indicate that the alarm has occured. The BI will not return to the inactive (0) state until the alarm has been acknowledged **even if the parameter is no longer in violation.** If alarm latching is enabled, it is therefore possible for a high alarm to occur (setting BI-1 to active) followed at some later time be a low alarm (setting BI-2 to active). **This will result in both the hi/lo alarm status indications (BI-1/2) being simultaneously active.** When the alarm condition(s) are acknowledged if the measurement is no longer in violation, the BI's will become inactive.

4. Alarm latching affects AI-1 status indications:

    - ♦ As noted in the previous item, AI-1 has a status attribute which reflects the current status of the point. Bits inthe status attribute are used to indicate whether the point is in hi/lo alarmviolation. Activation of these bits is affected by the setting of the alarm-latching feature of the Iso-Tek. In reporting alarms, the low alarm has priority over the high alarm. Thus if a high limit alarm occurs followed by a low limit violation (with no intervening alarm acknowledge), then only the low alarm will be reported in the AI-1 status attribute. If a low violation occurs, followed by a high violationwith no intervening acknowledge, then only the low violation will be reported since it has priority over the high violation. This could pose a problem in the interpretation of the data being recieved by the JCI BMS. It is recommended that the unit be set to NON-LATCHING alarms when the units are connected to an N2 JCI BMS. As the BMS is continually requesting the alarm point status from each of the units, there should not be an issuewith the BMS missing an alarm condition.

5. Value reported by AO-1,2 might not be the actual operating limits:

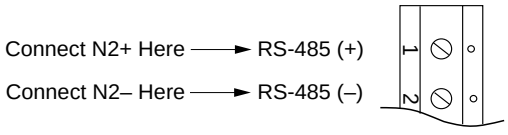
   ♦ These two point allow an N2 master to specify the magnitude of the hi/lo alarm limits in FPM. Note that these values specify only the magnitude of the limits. The actual alarm thresholds can be determined by examining the High/Low Alarm Limit attributes of AI-1. The values reported in AI-1 reflect the effect of the current Iso-Tek polarity whereas the AO-1,2 does not. **Also note that when the diplay override is off the values reported at AO-1,2 may be different from those reported via AI-1.** This is because with display override off, the potentiometer settings on the the display determine the alarm thresholds. These reregisters, when used correctly, will report the correct response. However, the JCI BMS user or persons implementing the BMS system must understand this information.

N2 Point Map

NPT	NPA	UNITS	POINT DESCRIPTION	RANGE / VALUE
A1	1	FPM	Transfer Air Velocity	-1000 to +1000
A0	1	FPM	Hi Alarm Setpoint	-1000 to +1000
A0	2	FPM	Lo Alarm Setpoint	-1000 to +1000
AO	3	SEC	Alarm Delay (15,30,60,120)	0
A0	4		System Configuration	See Below
B0	1		Alarm Horn Enable (1=enabled)	0 or 1
B1	1		Hi Alarm Status (1=Alarm)	0 or 1
B1	2		Lo Alarm Status (1=Alarm)	0 or 1
B1	3		Invalid Limits (1=Invalid)	0 or 1
BI	4		Hardware Fault (1=Fault,Vref or EE Checksum Error	0 or 1
BI	5		Local Alarm Ack (Overide=1 to Ack alarm, always reads as 0)	0 or 1

Configuration Setup details:
A four digit code defining the setup of the monitor.

Thousands digit:	**Polarity**	1; positive	2 ; negative	3; neutral	0; standby/off
Hundreds digit:	**Full Scale**	1; 100 fpm, .001 in H2O	2; 250 fpm, .005 in H2O	3; 500 fpm, .01 in H2O	4; 1000 fpm, .1 in H2O
Ten digit:	**Acknowledge Function**	0; is not latched	1; is latched		
Ones digit:	**Units**	0; in H20 1; fpm			



Notes:
1 – No terminal connection provided for N2 Ref
Keep shield continuous; do not tie to controller gnd
2 – Maintain polarity of communications wires
3 – Use jumper P6 to connect termination resistor
NT = no termination
T = termination connection

Fig. 10 - N2 Bus Connection

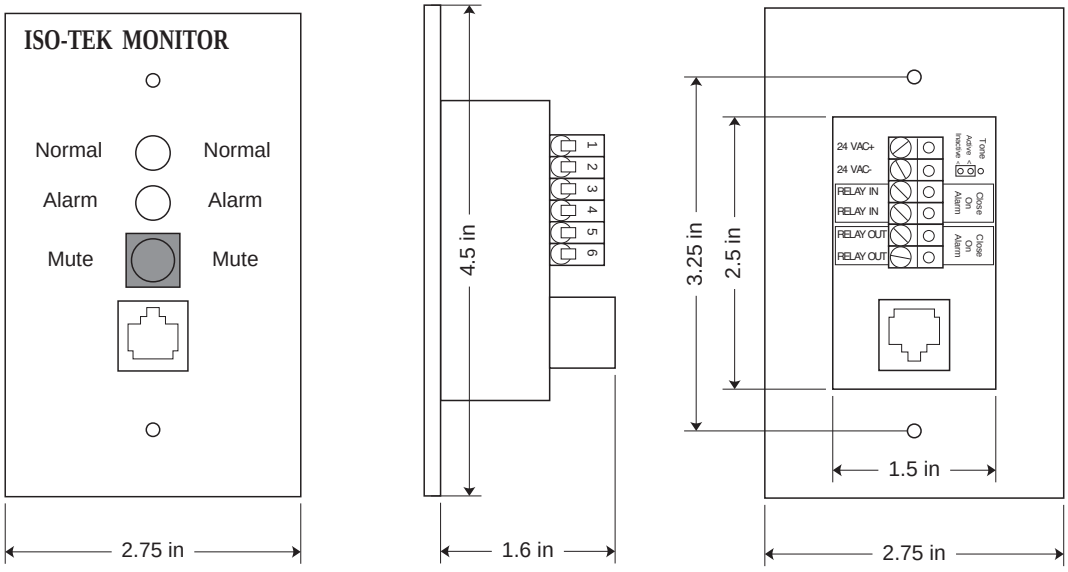
APPENDIX G: MODEL IMD-5000 MINI-DISPLAY FOR ISO-TEK

DESCRIPTION

The *ISO-TEK* MiniDisplay is designed to be used to indicate the status of a room being served by an *ISO-TEK* monitor. Small in size, the MiniDisplay indicates a room is safe with a green indicator, or in an unsafe alarm condition with a red indicator. The display incorporates a horn which is intended to provide an audible indication of the presence of an alarm. When pressed, a push button will silence the alarm horn.

The MiniDisplay also includes a communications jack to allow the user to connect an SPM-7000 *ISO-TEK* setup tool without accessing the transmitter, normally located above the ceiling line. Using the tool, the user can read the room pressure level, adjust alarm settings, and modify the *ISO-TEK* transmitter configuration.

The MiniDisplay alarm indicator is actuated by the *ISO-TEK* alarm contact and so this contact will not be available as an output to a building automation system (BAS). Where an alarm indication must also be sent to a BAS, a secondary contact is provided at the display and may be used for this purpose.



ISO-TEK MiniDisplay Dimensions

ALARM INDICATION

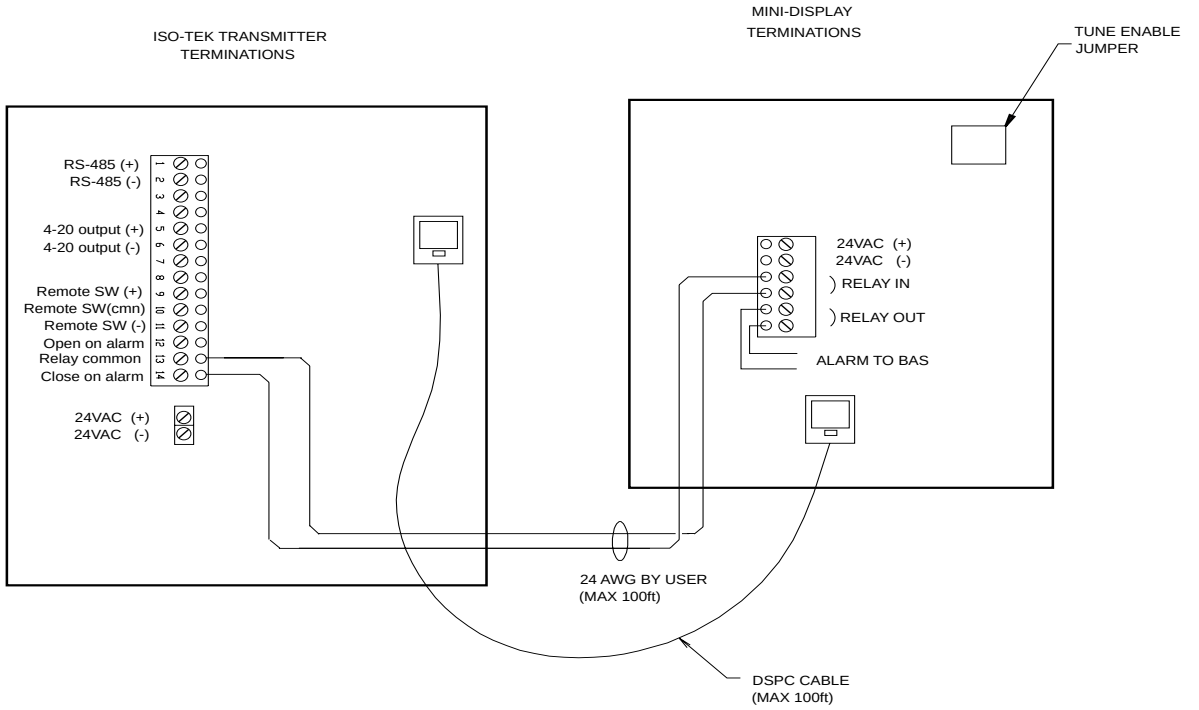
When the pressure level in the room being monitored is normal, only the green LED is lit. When an alarm condition exists for a length of time exceeding the time delay period established with the ***ISO-TEK*** configuration, the green LED turns off, the red LED will flash, and the alarm horn will sound. When the silence button is pressed, the horn will silence and the red LED will be lit steadily. Should the alarm condition clear, the red LED will turn off and the green will again be lit. The horn can be permanently deactivated via a jumper on the back of the display.

The contact closure which is provided for interface to a BAS is normally open and closes when an alarm condition is present. Contact operation follows the alarm condition and is not reset by the silence push-button.

INSTALLATION

The Mini-Display has the footprint of a light switch cover plate, mounts with two screws, protrudes less than one half inch from the wall, and has a beige finish. The display is designed to be mounted on a standard, 2"x4", electrical handi-box and requires no special mounting accessories or tools.

If the user wishes to connect the SPM-7000 Setup Tool at the Mini-Display an appropriate length DSPC cable is required. (see Model Code info.) The distance between the ISO-TEK transmitter and the Mini-Display is limited to 100 feet max. If the user intends to connect the SPM-7000 Setup tool at the transmitter rather than at the display, the tool connection cable is not required and the distance between components can be extended to five hundred feet.



ISO-TEK Mini-Display Wiring Diagram

* For more information on the Iso-Tek tool please contact your local Tek-Air Representative or the Tek-Air Sales Office for assistance, or refer to the SPM-7000 Setup Tool Operators' Instruction Manual.

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